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Evaluation of the RADARSAT-2 Major Crown Project

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LIST OF ACRONYMS

AAFC	Agriculture and Agri-Food Canada
CCRS	Canada Centre for Remote Sensing
CIS	Canadian Ice Service
CSA	Canadian Space Agency
CSE	Communication Security Establishment
DFAIT	Department of Foreign Affairs and International Trade
DFL	David Florida Laboratory
DFO	Department of Fisheries and Oceans Canada
DND	Department of National Defence
DRDC	Defence Research and Development Canada
EC	Environment Canada
EO	Earth Observation
EOADP	Earth Observation Applications Development Program
EOAU	Earth Observation Applications and Utilizations
EULA	End-User License Agreement
INAC	Indian and Northern Affairs Canada
LTSP-II	Long-Term Space Plan II
GCS	Government Consulting Services
GMTI	Ground Moving Target Indication
GoC	Government of Canada
GRIP	Government Related Initiatives Program
GSI	Geo-spatial Systems Inc.
IMOU	Interdepartmental Memorandum of Understanding
IRBs	Industrial and Regional Benefits
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
MA	Master Agreement
MCP	Major Crown Project
MDA	MacDonald, Dettwiler and Associates Ltd.
MODEX	Moving Object Detection Experiment
MOU	Memorandum of Understanding
NRCan	Natural Resources Canada
OGDs	Other Government Departments
OSC	Orbital Sciences Corporation
OTPG	Operations Transfer Planning Group
P3	Private-Public Partnership
PAMF	Project Approval and Management Framework
PCA	Parks Canada Agency
PER	Policy and External Relations
PIP	Project Implementation Plan
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute

PMO	Project Management Office
PPMS	Project Performance Measurement System
PS	Public Safety Canada
PWGSC	Public Works and Government Services Canada
SAR	Synthetic Aperture Radar
SatOps	Satellite Operations
SMEs	Small- and Medium-Sized Enterprises
SOAR	Science and Operations Applications Research
SPAC	Senior Project Advisory Committee
StatsCan	Statistics Canada
TAA	Technical Assistance Agreement
WBS	Work Breakdown Structure

Executive Summary

Background

This report presents the findings of the evaluation of the RADARSAT-2 Major Crown Project (MCP). The evaluation was undertaken to respond to the requirements for an evaluation of the project as outlined in the Treasury Board Secretariat (TBS) policies on Project Management and on the Management of Major Crown Projects. The Canadian Space Agency (CSA) engaged Government Consulting Services (GCS) to undertake the evaluation.

In June 1994, Cabinet gave approval to the Long-Term Space Plan II (LTSP-II) which, among other things, established Earth Observation (EO) as a priority of the Canadian Space Program and directed the CSA to develop an arrangement with the private sector for the development and operation of a RADARSAT-1 follow-on program.

RADARSAT-2 is the product of a unique partnership between the CSA and MacDonald, Dettwiler and Associates Ltd (MDA). This private-public partnership (P3) was governed by a Master Agreement (MA) which outlined all of the technical and legal details for the project. Under the MA, the spacecraft and the supporting ground system assets are owned by the private sector (i.e., MDA) for full commercial exploitation. For its participation, the government will receive data products and services. At the beginning of the mission, the Government has a credit of $445.95M and for every order filled, the government credit will be reduced by the price of the data products and services ordered.

Methodology

The RADARSAT-2 evaluation integrated three lines of evidence as a means to enhance the reliability and validity of information and data collected. The following research methods were used to gather information for the evaluation:

- document review;
- lessons learned analysis; and
- stakeholder interviews.

The evaluation focused on three main areas: project relevance, project implementation and management, and project impact.

Project Relevance

The RADARSAT-2 MCP is consistent with CSA's mandate, as outlined in the *Space Agency Act*, to be involved in programs and projects related to the development and application of space technology, as well as the procurement of such systems. In addition, the MCP was designed specifically to address federal government priorities laid out in the LTSP-II, which emphasized the commercial potential of the EO sector. The LTSP-II also emphasized the importance of creating a partnership with a private sector firm which would gain the capabilities to sustain the

EO sector. Thus, the RADARSAT-2 MCP was designed, not only to provide data continuity for RADARSAT-1, but also to develop the capacity of the private sector for the purpose of developing the EO sector, thereby addressing the priorities of the federal government to develop that sector.

Project Implementation and Management

Overall, the RADARSAT-2 MCP benefitted from an experienced and stable project management office (PMO), which put in place the necessary project management tools and fulfilled the mandatory requirements as per the TBS policies. The PMO also established good working relationships and effective mechanisms for communication with both partners and other CSA Directorates, being both open and transparent.

> **Recommendation #2**: *For future projects, the CSA should model the success of the PMO during the RADARSAT-2 MCP in ensuring openness and transparency and establishing good communications both with partners and other CSA Directorates.*

The CSA also established a good working relationship with MDA and put in place effective mechanisms for communication and information exchange between the two partners, although there were issues with respect to the clarity of common objectives and of the roles and responsibilities of each partner.

> **Recommendation #3**: *For future projects, the CSA must ensure that the common objectives between itself and business partners as well as the roles and responsibilities of all partners are clearly articulated early in project documentation.*

The evaluation identified two additional issues with respect to project implementation and management which merit consideration in future projects. First, the evaluation identified security as a key issue. While the MA included partial security provisions, there appears to have been difficulties with respect to the timely identification of security issues, which resulted in additional cost and effort being expended beyond what should have been required.

> **Recommendation #1**: *The CSA must ensure that issues such as security are given much more priority and are addressed at the outset of the project.*

The CSA has largely completed the close-out of the RADARSAT-2 MCP; however there were issues with respect to the implementation of the transition plan (i.e., from development to operations) associated with questioning of CSA's role in the ongoing operation of RADARSAT-2 as defined in the MA. This also led to difficulties between the PMO and one CSA Directorate.

> **Recommendation #5**: *For future projects, the CSA must ensure that CSA's role is clearly defined at the beginning and that all CSA representatives are comfortable with that role and accept their responsibilities in fulfilling that role.*

With respect to the overall success of the P3, stakeholder views were mixed, with MDA suggesting that it was a success, given that the project was completed and the partners obtained what was desired. Some government stakeholders believe that the P3 was not successful for the Government of Canada (GoC), primarily because the CSA had insufficient control over the project, the GoC absorbed all of the project risk and paid for most of the system, and in the end the GoC does not own the system. A CSA representative indicated that the GoC did not absorb all of the risk; rather it was absorbed by MDA. While the costs for RADARSAT-2 were less than that of RADARSAT-1, a full cost-effectiveness analysis would have to be conducted to determine whether this model was the most beneficial to the GoC.

> **Recommendation #4**: *The CSA should conduct a cost-effectiveness analysis to determine whether the savings generated by using the P3 model resulted in similar benefits to the GoC to those resulting from RADARSAT-1.*

Project Impact

While the CSA was successful in implementing the project, the evaluation showed that the project has fallen short of reaching some of its key objectives, particularly with respect to developing the EO sector.

The evaluation found that RADARSAT-2 was a technical leap from RADARSAT-1 and that the project helped continue Canadian leadership in the satellite application of SAR technology, particularly in SAR on-time capability. However, launch delays prevented Canada and Canadian industry from being first to market with a new generation of commercial SAR offerings. By the time RADARSAT-2 was launched, there were other similar systems in operation, although perhaps with less powerful capabilities.

The RADARSAT-2 MCP also aimed to develop the EO sector; much like the commercial satellite communications sector had been developed. The project was successful in developing MDA's expertise in the EO sector and, as a result of its participation in RADARSAT-2, MDA was able to acquire a number of other contracts for other space programs. Overall the project may result in a profitable business for MDA, although not as profitable as once expected. There is a lack of evidence to determine whether the value-added sector will benefit and it is likely too early to see results. Note that the CSA recognizes that the original intent of the MCP to develop the EO business did not materialize as expected. As a result, the CSA is moving forward with a next generation satellite with a different model.

> **Recommendation #6**: *Because the benefit to the value-added sector was a critical factor in the success of RADARSAT-2 the CSA needs to establish appropriate measures to determine the impact of RADARSAT-2 on the value-added sector.*

Overall, the CSA was successful in ensuring data continuity for the users of RADARSAT-1 data and the GoC has acquired scenes during the first year of operation of RADARSAT-2. The CSA has also helped facilitate the use of RADSARSAT-2 data by undertaking promotion and communication on the potential uses and benefits of the data, by covering the costs of data processing for other government departments (OGDs), by supporting applications development, and finally, by working to put Memorandum of Understanding (MOUs) in place with OGDs to govern the receipt and use of data.

> **Recommendation #7**: *Because the long-term success of RADARSAT-2 is dependent on the optimal use of data by OGDs, the CSA must continue its efforts to facilitate the use of data and ensure that any barriers to use are minimized.*

While the CSA is not accountable for the use of RADARSAT-2 data, is it responsible for reporting on the benefits of the investment to the GoC.

> **Recommendation #8**: *The CSA must ensure that OGDs are fulfilling the annual reporting requirements for the use of data and that the data being provided is adequate to report on the benefits of RADARSAT-2 to the GoC.*

Overall, the RADARSAT-2 MCP was successfully managed and implemented, with the exception of a few issues related to security and the clarity and acceptance of roles and responsibilities. The CSA was also successful in providing data continuity with a system that is a technical advancement over RADARSAT-1. In determining the overall long-term benefits of RADARSAT-2, the CSA must put in place the proper performance monitoring system to measure for example the benefits of the project to the value-added sector and to assess whether the P3 model was a good investment for the GoC (i.e., maximum benefit for the cost) which is dependent on the use of data by OGDs.

1.0 Introduction

This report presents the findings of the evaluation of the RADARSAT-2 Major Crown Project (MCP). The evaluation was undertaken to respond to the requirements for an evaluation of the project as outlined in the Treasury Board Secretariat (TBS) policies on Project Management and on the Management of MCPs.[1] The Canadian Space Agency (CSA) engaged Government Consulting Services (GCS) to undertake the evaluation.

The objective of the study was to evaluate the MCP in terms of relevance, project implementation and management, and project impact. The research for this evaluation was conducted during April and May 2009. The evaluation report is organized as follows:

- Section 1 presents a description of the RADARSAT-2 MCP;
- Section 2 presents the methodology for the evaluation;
- Section 3 presents findings by evaluation issue and question; and
- Section 4 presents the conclusions and recommendations.

1.1 History of the Major Crown Project

In June 1994, Cabinet gave approval to the Long-Term Space Plan II (LTSP-II) which, among other things, established Earth Observation (EO) as a priority of the Canadian Space Program. The CSA was directed to develop an arrangement with the private sector for the development and operation of a RADARSAT follow-on program to start in 1994/95 that would maintain continuity of data following RADARSAT-1.[2] A competitive process led to the selection of MacDonald, Dettwiler and Associates Ltd. (MDA) as the private sector partner for RADARSAT-2 development.

RADARSAT-2 is Canada's second-generation Synthetic Aperture Radar (SAR) satellite and is designed with powerful technical advancements that provide enhanced information for applications such as environmental monitoring, ice mapping, resource mapping, disaster management, and marine surveillance.

RADARSAT-2 is the product of a unique partnership between the CSA and MDA. To form the private-public partnership (P3), the CSA entered into a Master Agreement (MA) with MDA. The MA outlines all of the technical and legal details for the project. Under the MA, the spacecraft and the supporting ground system assets are owned by the private sector (i.e., MDA) for full commercial exploitation. For its participation, the government will receive data products and services. At the beginning of the mission, the government had a credit of $445.95M. For

[1] TBS Policy on Project Management (http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=12077); TBS Policy on the Management of Major Crown Projects (http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=12040).

[2] RADARSAT-1 is a sophisticated EO satellite developed by Canada to monitor environmental changes and the planet's natural resources. Launched in November 1995**,** RADARSAT-1 provides Canada and the world with an operational radar satellite system capable of timely delivery of large amounts of data. Equipped with a powerful SAR instrument, it acquires images of the earth day or night, in all weather and through cloud cover, smoke, and haze. (http://www.asc-csa.gc.ca/eng/satellites/radarsat1/default.asp)

every order filled for new data, the government credit will be reduced by the price of the data products and services ordered. The CSA also developed a Memorandum of Understanding (MOU) with the Canada Centre for Remote Sensing (CCRS) for data reception and archiving services. These agreements were amended in December 2007 to reflect updated and more detailed operational requirements.

1.2 Objectives of the Major Crown Project

According to project documents, the RADARSAT-2 MCP had seven key objectives. The objectives were revised by the CSA and approved by TBS in 2004.[3] These objectives are summarized in Table 1.

Table 1. RADARSAT-2 Major Crown Project Objectives

Performance Through its participation in the RADARSAT-2 MCP, the CSA, in partnership with the private sector (i.e., MDA), had the intent to continue Canadian leadership in SAR technology through the provision of a follow-on space-based remote sensing system that functions independently of atmospheric conditions.
Business CSA has an objective to ensure that the EO business in Canada is developed into a world-leading, profitable, and sustainable business. MDA was selected as the private sector partner as a result of a competitive process because, in addition to a suitable technical approach, it developed a strong business case. A key to growing the business is the development of the valued-added industry. To this end, MDA proposed programs to support and foster developments in this sector.
Partnership The CSA, responding to the direction given by Cabinet in the LTSP-II intents to transfer implementation and operational responsibility to a private sector partner (i.e., MDA). This includes ownership of system assets (spacecraft and ground control system) as detailed in the MA.
International Cooperation There was an intention to collaborate with NASA for the launch and with Orbimage for data distribution. As described in the Project Brief, these partnerships did not materialize, although other collaboration was done for data distribution.
Cost The cost for RADARSAT-2 was $528.8M, with a $437.1M contribution from the Government of Canada (GoC) (i.e., $15.5M from the Department of National Defence (DND) and $421.6M from the CSA) and $91.6M is contributed by MDA.
Schedule In 2004 TB submission, the schedule was updated to reflect a launch delay planned for 2005. . Following a commissioning period, the operations phase will run from March 2006 till April 2013. Major milestones were: • Delta Mission Preliminary Design Review – March 2001 • Mission Critical Design Review - June 2002 • Spacecraft Test Readiness Review – December 2004 • Operations Validation Review – August 2005 • Launch – December 2005 • Commissioning Complete Review – March 2006 • Decommissioning Review – April 2013
Industrial and Regional Benefits The Canadian content objective for the construction of the spacecraft and ground segment under the MA with MDA is 65 percent (base cost of $402.35M). MDA contractually committed to 50 percent Canadian content. The Canadian content for the ground receiving system upgrade at the CCRS, excluding the RADARSAT-2 Archive (base cost of $6.8M) is 75 percent.

[3] Canadian Space Agency. *RADARSAT-2 Major Crown Project Close-out Report.* April 2009.

1.3 Scope of the Major Crown Project

The RADARSAT-2 MCP is defined as covering all activities related to the design, development, test, launch, and deployment of the satellite. The original scope of the project was expanded to include the Ground Moving Target Indication (GMTI) modifications, the addition of the launch supplier, upgrades of the ground receiving and archiving facilities owned and operated by CCRS, and the modifications for a possible tandem operation.

The RADARSAT-2 design and construction represent a significant evolution from RADARSAT-1 with new capabilities designed to ensure Canada's continued leadership in the SAR global marketplace. The development and deployment phases of the project ended in April 2008 following the Commissioning Complete Review (CCR). The operations phase is expected to last seven years. During the operations phase, the satellite and its ground-based receiving and processing elements will provide data for federal government and commercial users.

Although the RADARSAT-2 MCP ended after the close-out was completed, the RADARSAT-2 Program and the MA with MDA will continue for the life of the mission.

2.0 Evaluation Methodology

2.1 Evaluation Questions and Issues

The evaluation of the RADARSAT-2 MCP was guided by an evaluation matrix that was developed during a planning phase for the evaluation. Note that the matrix was designed to meet the needs of the CSA, as identified in the RADARSAT-2 Close-out Plan, but also to respond to TBS requirements with respect to the evaluation of MCPs.

The evaluation questions were organized into four main issue areas: project relevance, project implementation and management, project impact, and other. Table 2 provides a summary of the evaluation questions examined (see Appendix A for the complete evaluation framework). It should be noted that this evaluation examined the management and impact of the project and did not assess technical / scientific aspects of the satellite.

Table 2. Summary of Evaluation Issues and Questions

Evaluation Issue	Evaluation Question
Project Relevance	• Was the RADARSAT-2 MCP consistent with federal government policies and priorities and the CSA's mandate, mission, and objectives?
Project Implementation and Management	• To what extent did the RADARSAT-2 MCP fulfill the mandatory requirements for the management of an MCP? • Were sufficient financial and human resources allocated to the project given the scope, complexity, partnership arrangement, and risk of the project?[4] • How effective were the agreements between the CSA and other government departments (OGDs)? • To what extent did the Project Management Office (PMO) establish good working relationships with other CSA directorates? • How effective was the project management plan, the project organization, tools, and management systems? • How well did the private-public arrangement work? • Has the CSA successfully completed the close-out of the MCP?
Project Impact	• To what extent did RADARSAT-2 contribute to the continuation of Canadian leadership in SAR technology (e.g., use of state-of-the-art SAR technology, distribution of SAR data)? • To what extent did RADARSAT-2 contribute to the development of EO business in Canada? • To what extent did RADARSAT-2 bring about industrial and regional benefits in Canada? • To what extent did RADARSAT-2 meet its international objectives (e.g., NASA agreement)? • To what extent is the CSA ready for the optimal use of data allocation by OGDs?
Other	• What best practices or lessons learned can be carried forward to future projects? • Did RADARSAT-2 MCP result in any value-added activities or expertise gained with the PMO?[5]

[4] The findings from this question have been incorporated into section 3.2.1 (*Fulfillment of the Mandatory Requirements for the Management of an MCP*) and section 3.2.4 (*Effectiveness of Project Management*).
[5] The findings from this question have been incorporated into section 3.2.5 (*Success of Private-Public Partnership*).

2.2 Evaluation Methodology

The RADARSAT-2 evaluation integrated three lines of evidence as a means to enhance the reliability and validity of information and data collected. The following research methods were used to gather information for the evaluation:

- document review;
- lessons learned analysis; and
- stakeholder interviews.

Each of these methods is described in more detail below.

2.2.1 Document Review

A review of relevant documentation was undertaken to assess project relevance, project implementation and management, and project impact. The types of documents reviewed can be grouped into two main categories:

Background and authority documents: including foundation documents for the RADARSAT-2 MCP and related agreements and policies.

Project documents: including documents related to project management and implementation (e.g., risk framework, project approval framework) and project reporting.

The document review was conducted using a customized template to extract relevant information from the documents and organize it according to the indicators and evaluation questions. Appendix B contains a list of documents that were reviewed for the evaluation.

2.2.2 Lessons Learned Analysis

Between 2006 and 2008, the CSA completed a lessons learned exercise, which was conducted primarily to collect information to improve project management for future, similar projects. In completing the lessons learned exercise, a series of in-depth interviews and focus groups were held with numerous project stakeholders. In addition to incorporating the findings from this exercise into the evaluation, GCS completed an analysis of available interview and focus group information (i.e., raw notes), extracted relevant information, and incorporated the results where possible. Note that there were certain limitations with this methodology, which are explained in Section 2.3 (*Limitations of Methodology*).

2.2.3 Stakeholder Interviews

Interviews served as an important source of information by providing qualitative input on the relevance of the project as well as project implementation and management, and project impact. A total of 31 interviews were completed, including: the senior manager responsible for the project; representatives of the PMO; representatives of other CSA Directorates (e.g., Finance, Communications); MDA and GSI; CCRS; and other partners and / or users of RADARSAT-2 (Table 3). The interviewees were selected in collaboration with CSA representatives to ensure that the appropriate interviewees were included (see Appendix C for a list of interviewees).[6]

Interviews were conducted either by telephone or in-person. Most CSA interviews were conducted at the CSA offices in St. Hubert, Quebec. Interviews were generally between one and one and a half hour in length. All interviewees were contacted to schedule an appropriate time and sent an interview guide in advance of the interview (see Appendix D for the interview questions).

For analysis purposes and to maintain confidentiality, the interviewees were grouped into four main categories, as shown in the 'analysis groups' column in Table 3. Note that not all interviewees responded to all questions. Therefore throughout the report, the number of interviewees who commented on a certain question does not always equal the total number of interviewees in a given analysis group.

Table 3. List of Interview Groups

Group	Number of Interviews Conducted	Analysis Groups	Number in each Analysis Group
Senior Manager	1	PMO	9
PMO	8		
Other CSA Directorates	12	Other CSA Directorates	12
MDA / Geo-spatial Systems Inc. (GSI)	4	MDA / GSI	4
CCRS	1	Partners / Users	6
Partners / Users	5		
Total	**31**		**31**

2.2.4 Analysis of Data Collected

Once data collection was completed, GCS conducted an analysis of the information according to the evaluation questions and indicators and developed a synthesis of the findings by line of evidence (i.e., an evidence matrix). This analysis was used as the basis for the development of the evaluation report.

[6] Interviews with the value-added sector was not included as part of the methodology.

2.3 Limitations of Methodology

There were no significant limitations to the methodology. While the evaluation relied heavily on qualitative sources of information (e.g., documents and interviews), which is often viewed as a limitation, in this case, project documentation and interviews with those involved in the project were deemed sufficient to formulate conclusions given the nature of the evaluation questions.

Analysis of the original notes from the lessons learned interviews and focus groups revealed that not all questions were asked consistently to all interviewees and not all interviewees responded to all questions, making it impossible to conduct a thematic analysis. Therefore, this information was used only where there were at least four responses to a question. While this information was used to supplement evaluation findings, it cannot be viewed as representative of all lessons learned interviewees and focus group participants.

3.0 Evaluation Findings

This section of the report presents a summary of the evaluation findings organized into the issue areas of project relevance, project implementation and management, project impact, and other.

3.1 Project Relevance

3.1.1 Consistency of the RADARSAT-2 Major Crown Project with Federal Government Priorities and the CSA Mandate

Finding: *The RADARSAT-2 MCP was consistent with federal government priorities and the CSA mandate to develop the EO industry in Canada and to ensure data continuity.*

The objectives of the RADARSAT-2 MCP, as outlined in the RADARSAT-2 MCP Close-out Report (see Section 1.2 of this report) and the MA, focused on ensuring data continuity with the RADARSAT-1 mission, the commercialization of operations, and the provision of SAR data in support of government operations. Interview information from the CSA and partners / users was consistent with the documentation, with virtually all interviewees (15 of 16) suggesting that the objective of the project was to ensure data continuity and many (10 of 16) suggesting that the objective was to develop the EO sector.

Federal priorities related to Canada's participation in space programs were laid out in the LTSP-II, which provided an overview of priorities for the CSA to the year 2005, as well as intended programs and their benefits. The plan emphasized the commercial potential of the EO sector, which was believed to be on the verge of dramatic growth comparable to that witnessed in the commercial satellite communication sector. RADARSAT-2 was envisaged as a vehicle to establish Canada's prominence in this field by providing leading technical capabilities to support development of a self-sustaining private sector. Furthermore, the plan discussed the importance of creating a national champion ─ a private sector firm with sufficient systems engineering and technical capabilities to sustain the sector.[7]

Thus, RADARSAT-2 objectives were consistent with these goals given their focus on EO, as well as the intent to build the capacity of the private sector partner. This conclusion was supported by CSA interviewees, four of five of whom suggested that the project's objectives were consistent with the federal priority to develop the EO business in Canada.

The RADARSAT-2 MCP was also consistent with the CSA mandate. The *Canadian Space Agency Act* stipulates that the Agency be involved in programs and projects related to the development and application of space technology, as well as the procurement and maintenance of such systems. In addition, the Agency is to promote the transfer and diffusion of space technology to and throughout Canadian industry. RADARSAT-2 objectives are in line with these stipulations given their focus on the application of space technology and transferring that

[7] Canadian Space Agency. *Canada's Long-Term Space Plan II: Vision, Strategy and Program to Year 2005.* 7 April 1993.

technology to Canadian industry.[8] Again, interviewees expressed their belief that RADARSAT-2 MCP was aligned with the CSA mandate through the objective to develop the EO business. Therefore, the RADARSAT-2 MCP addressed both the federal priority to develop the EO sector and the CSA mandate to promote the development of space technology throughout Canadian industry.

3.2 Project Implementation and Management

3.2.1 Fulfillment of the Mandatory Requirements for the Management of a Major Crown Project

Finding: *The project met the mandatory requirements as per the TBS policies. It should be noted that TBS policy requirements are geared towards more conventional procurement projects and the CSA tailored these requirements to suit the nature of the project.*

As an MCP, RADARSAT-2 was required to fulfill the mandatory requirements as set forth by the TBS policies on Project Management and on the Management of Major Crown Projects. It is important to note that the P3 was unique for the CSA in that it was overseeing the work of MDA through the MA to ensure that the spacecraft would provide the data for which CSA pre-paid. In other words, CSA was not contracting a company to produce a good or service for the Agency. Rather, it was overseeing the work of a company that would own the asset. This meant that the CSA had limited control over the project.

As TBS policies, intended primarily for internally managed projects, provide latitude to establish approaches suited to the scope, complexity, and objectives of each project, it was expected that the CSA would establish processes, principles, and tools appropriate for the nature of the project. For the purposes of the evaluation, TBS policy requirements were grouped into six main categories. The findings in each category are summarized below. Note that this section of the report assesses how well the CSA responded to the mandatory requirements. For an assessment of how effective the CSA was in managing the overall project, see Section 3.2.4 (*Effectiveness of Project Management*).

Project Accountability

As required, a senior manager (Director General of Space Programs) was appointed project leader for the RADARSAT-2 MCP and was accountable for the implementation of the project. The Director of EO Projects was named as the project manager and was accountable to the project leader for the successful implementation and execution of the project. The CSA also assigned a deputy project manager, who reported to the project manager.

[8] Government of Canada. *Canadian Space Agency Act.* 1990. (http://laws.justice.gc.ca/en/C-23.2/index.html)

A Senior Project Advisory Committee (SPAC) was established for the RADARSAT-2 MCP and was responsible for advising the project leader in the conduct of the project. The SPAC was chaired by the RADARSAT-2 project leader and included representation from central agencies as well as from many departments with interests in the technical aspects of the mission, data provision, and regional benefits.[9] Throughout the course of the project, at least nine SPAC meetings were held, with a final meeting held June 19, 2009 (i.e., for the close-out of the MCP). These meetings were held roughly once a year, except for a hiatus between 2004 and 2006.[10] PMO and partner / user interviewees who attended the meetings suggested that the SPAC was effective (5 of 8) primarily as an information sharing forum. The remaining three interviewees believed it was moderately effective, citing issues related to gaps in meetings frequency and the fact that the meetings did not provide a lot of direction.

Project Scope

The initial RADARSAT-2 project scope was well defined in the original Project Brief; the scope was kept-to-date; and changes were outlined in project-related documentation. The RADARSAT-2 Project Brief documented the following major changes in the scope of the RADARSAT-2 project:

- Inclusion of critical modifications to the RADARSAT-2 spacecraft needed to support a tandem mission with a possible RADARSAT-3, as identified in the RADARSAT-3 feasibility study being carried out by MDA.

- The Technical Assistance Agreement (TAA) for an Orbital Sciences Corporation (OSC) supplied bus was delayed until August 1999 when a partial TAA was offered. The partial TAA contained restrictions unacceptable to the CSA and the federal government. The CSA requested MDA to investigate a non-US bus supplier. Subsequently, a contract was given to Alenia Aerospazio of Italy for the supply of the RADARSAT-2 bus. The termination of the OSC contract, coupled with project delays, resulted in an increase in CSA costs.

- In 1998 NASA back out of an agreement to provide the launch in return for data. Since the launch is a CSA responsibility, it had to be procured at additional expense to the CSA, although a 2005 decision to switch from a Delta II to a Starsem launch, resulted in a net reduction in project costs.

[9] According to SPAC meeting minutes, the following departments have attended SPAC meetings, although not necessarily all meetings: Agriculture and Agri-Food Canada, Atlantic Canada Opportunities Agency, Canada Centre for Remote Sensing, Canada Economic Development, Communication Security Establishment, Communications Research Centre, Department of Finance Canada, Environment Canada, Fisheries and Oceans Canada, Department of Foreign Affairs and International Trade, Department of National Defence, Indian and Northern Affairs Canada, Industry Canada, Justice Canada, Natural Resources Canada, Privy Council Office, Public Safety Canada, Public Works and Government Services Canada, Statistics Canada, Treasury Board Secretariat, Western Economic Diversification.

[10] The dates of the SPAC meetings were: 30 June 1999, 13 March 2000, 19 May 2000, 12 June 2001, 21 May 2002, 1 December 2003, 12 July 2006, 3 May 2007, 3 July 2008, and 19 June 2009.

- The overall cost of the RADARSAT-2 MCP increased as a result of the addition of the MODEX capability. The increased cost was funded by DND and did not impact CSA's RADARSAT-2 budget.

- Inclusion of CCRS infrastructure upgrades into the RADARSAT-2 Project.

Project Management Framework

The Project Implementation Plan (PIP) was developed to establish the management framework for the implementation of the project and described the management structure, organisation, methodology, and tools to be employed by the CSA. The plan formed the basis against which project progress was measured and potential problems detected and assessed so that timely corrective actions could be taken. To further facilitate the planning and management of the project, the PMO developed a detailed Work Breakdown Structure (WBS), which was used for:

- scheduling tasks;
- estimating and allocating resources;
- reporting cost and schedule;
- assessing project status and organizational performance; and
- ensuring that all program objectives are met.

To facilitate the implementation of the RADASAT-2 MCP, the CSA established a PMO with full-time resources dedicated to the project. There is limited information available to determine the exact number of resources, although the PIP showed that over a three-year period (2001-2002 to 2003-2004) the equivalent of 11 full-time staff worked on the project. Note this includes full-time PMO staff and other CSA staff who were involved on a part-time basis. Information from the lessons learned report suggests that sufficient resources were allocated to the project, although perhaps late in the process. The report suggested that during the ten-year span of the project (from 1998 to 2008), the project "enjoyed exceptional stability and continuity among the key players both within the CSA and MDA."[11] However the same report noted that the responsibility for managing certain complex issues fell to the PMO, which had a very small core team. The report further noted that while dedicated resources with the necessary expertise were ultimately mobilized for the project, it occurred late in the process and had it not been for some schedule slippage, there was a high probability that these issues would not have been resolved sufficiently by the launch date.[12]

[11] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #2: Project Management Office Stability).
[12] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #15: Project Management Structure – Private-Public Partnerships).

Project Management Principles

The TBS Policy on Project Management requires the establishment of project management principles. To respond to this requirement, the CSA developed the Project Approval and Management Framework (PAMF). The PAMF was modeled on the requirements laid out in the Project Management Institute's (PMI) Project Management Body of Knowledge (PMBOK) and established the accepted policies, procedures, and practices for the MCP. When asked about project management principles in place, the PAMF was the document most cited by PMO interviewees (6 of 7). Interviewees also cited the TBS Policy on Project Management, the TBS Policy on Project Approval, and the TBS Policy on the Management of Major Crown Projects as other project management principles in place.

Most PMO interviewees (4 of 5) indicated that the principles outlined in the PAMF were appropriate given the nature of the project. The other PMO interviewee suggested that the principles were beyond what was required for the project (e.g., the CSA was purely doing oversight). All PMO interviewees that responded indicated that the principles were followed by all staff (6 of 6).

Project Profile and Risk Assessment

A project profile was developed which outlined all the parameters of the project, including the context and need for the program, description, objectives and planned results, stakeholders and beneficiaries, the governance structure, the CSA functions during the operations phase, and resource allocation.

According to the 2004 RADARSAT-2 Project Brief, the CSA established a risk management framework for the RADARSAT-2 MCP that was "consistent with the risk management framework recently developed by the CSA and submitted for approval to TBS in December 1999."[13] The CSA identified the deputy project manager as the project risk manager with responsibility to manage and co-ordinate the risk management process. Each risk was also assigned to a risk manager for action. Major risks were identified throughout the project and tracked in a risk database. Thirty-three risks were identified, including financial and scheduling risks, technical risks, and risks associated with the launch itself. Risk mitigation strategies were identified for these risks.

The lessons learned report concluded that the risk management "processes within the CSA are working very well and were a contributory to excellent awareness of key issues and the timely development of a risk avoidance and mitigation strategy by the CSA management team." In addition, the risk management process was "viewed by several offices as being mature and effective. All respondents indicated that they were very comfortable with the manner in which they maintained awareness of the risks to the RADARSAT-2 MCP and how they could contribute to the risk management system in the CSA."[14]

[13] Canadian Space Agency. *RADARSAT-2 Revised Project Brief*, October 2004, page 53.
[14] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #10: Risk Management).

Project Performance Measurement System

With respect to establishing a project performance measurement system (PPMS), TBS guidelines provide latitude to the PMO to establish something appropriate for the scope, complexity, and objectives of each project. According to the lessons learned report, the CSA did not implement a formal PPMS "because of the contribution by MDA and their reluctance to expose details on their own costs. To have been successful, a PPMS would have had to be demanded of MDA with their bid submission and employed in an integrated manner with the CSA. It would not have been practical for the CSA to establish PPMS in isolation, as this would not have reflected the full scope of activities within the project."[15]

Although the CSA did not establish a PPMS, it did establish formal reporting requirements, which included a series of five mission system reviews, four segment level (space and ground segments) reviews, MDA weekly reports, MDA monthly project status reports, CSA / MDA quarterly progress review meetings, and MDA quarterly Industrial and Regional Benefit (IRB) reports. All of these mechanisms provided the CSA with information on all aspects of the project (e.g., progress, cost, schedule, and technical issues).

3.2.2 Effectiveness of Partnership Agreements

Finding: *The CSA was effective at managing its partnership agreements with OGDs, although some partners were not positive about the relationship, citing issues with respect to roles and responsibilities and security.*

As part of the RADARSAT-2 MCP, there were a number of agreements put in place by the CSA. In 1998, the CSA signed an MOU (Schedule F-3 of the MA) with CCRS (an annex to the CSA-Natural Resources Canada (NRCan) MOU) with respect to the upgrading and operation of the ground receiving and archiving infrastructure. Further to this agreement, Schedule F-4 of the MA (signed in 2007) formalized the arrangement for the operation phase with respect to receiving, archiving, and cataloguing of RADARSAT-2 data. The CSA also had two supporting arrangements in place with DND. One was to incorporate modifications into the RADARSAT-2 satellite and ground segments to evaluate a Moving Object Detection Experiment (MODEX) mode as an experimental proof of concept.[16] The second was to incorporate modifications into the RADARSAT-2 satellite to permit tandem operation with a future RADARSAT-3 mission.[17]

[15] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #13: Project Performance Management System).
[16] Canadian Space Agency and Department of National Defence. *Supporting Arrangement Number 1. Revision #1. The Development and Demonstration of a Ground Moving Target Indication Mode on RADARSAT 2.*
[17] Canadian Space Agency and Department of National Defence. Supporting Arrangement #2. Modifications to the RADARSAT-2 Spacecraft to permit Tandem Operation with a Future RADARSAT-3.

The CSA also had a service agreement in place with Public Works and Government Services Canada (PWGSC), which allocated resources to the MCP to provide contract support. Finally, the CSA had an Interdepartmental Memorandum of Understanding (IMOU) in place with OGDs in support of RADARSAT-2 launch operations. PWGSC, DND, and the Communications Security Establishment (CSE) comprised a security-monitoring team and oversaw the security aspects before and during the launch.

CSA interviewees (PMO and other CSA Directorates) were very positive about the effectiveness of the partnership agreements that were in place (5 of 6). However, one PMO interviewee was not as positive, citing difficulties with the relationship with one partner, primarily because that partner's role in the MCP was not clear. Only four of seven partners commented on the effectiveness of the partnership agreements. All suggested that the agreements were well written, well-negotiated, and provided the framework for working together.

Information from interviews showed that the CSA worked with its partners on an as needed basis and provided them with information via CSA's progress reporting (e.g., monthly reports and quarterly progress reports). When asked to rate their working relationship with the CSA, many partners rated the relationship positively (5 of 8), indicating for example that there was a very good working relationship with the PMO; that the PMO was accessible / responsive; and that the PMO was very good / experienced.

The other partners were not as positive about their relationship with the CSA, citing issues with respect to roles and responsibilities, differing opinions, and a lack of foresight with respect to certain issues (i.e., security). While the information from the document review showed that security provisions related to access control (i.e., Schedule H-1), the up-link command (i.e., Schedule H-2), and cryptographic solutions (i.e., Schedule H-3) were included in the MA, one partner felt that it received information from the CSA and MDA too late, and therefore it was a challenge to ensure that appropriate security provisions were incorporated. This is supported by information from two lessons learned highlighted in the report, which stated that "security issues were not addressed adequately at the outset of the Project and many issues arose that were unforeseen…the resolution of issues required a more costly solution and a disproportionate level of effort from the CSA PMO, MDA, and partners;"[18] and that "several security issues were only identified when they became essential or urgent."[19] Part of the difficulties with the security issue can be attributed to the fact that the *Remote Sensing Space Systems Act (RSSSA)* was introduced at the time of RADARSAT-2. As a result, the CSA had to deal with many new issues not encountered in previous projects.

[18] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #8: Project Security Officer).
[19] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #17: Security – Launch Campaign).

3.2.3 Relationship between the Project Management Office and other CSA Directorates

Finding: *The PMO established good working relationships with other CSA Directorates and created mechanisms for communicating and sharing information within the CSA.*

Information from documents and interviews showed that there were formal mechanisms (i.e., committees and meetings) for communication and information exchange between the PMO and other CSA Directorates. The Operations Transfer Planning Group (OTPG) was the only formal committee internal to the CSA established specifically for the RADARSAT-2 MCP. The OTPG was chaired by Satellite Operations (SatOps) and was established to address issues related to the transition from construction to operations. In addition to this committee, a number of other formal mechanisms were established. The mechanism cited most frequently by interviewees was the PMO weekly meeting (11 of 21). Information from interviews showed that representatives from Earth Observation Applications and Utilizations (EOAU), Communications, and Systems Engineering regularly attended these weekly meetings. Representatives of other CSA Directorates (e.g., Finance, Policy and External Relations (PER), and SatOps) indicated that they did not generally attend the weekly PMO meetings and interaction with the PMO was as needed. Interviewees also cited the senior quarterly reviews / reports, the DG review, the CSA monthly report, and the weekly technical status report as mechanisms for information exchange between the PMO and other CSA Directorates.

Interviewees were generally positive about the quality of the working relationship between the PMO and other CSA directorates. Five of six PMO interviewees rated the relationship as positive. Many interviewees from other CSA Directorates also rated the working relationship positively (8 of 12), suggesting, for example, that the PMO was open and transparent and provided good information and communications. One Directorate was neutral about its relationship with the PMO, indicating that the PMO was not very proactive. Another Directorate rated its relationship with the PMO negatively, citing issues of a lack of resources for the PMO and a lack of clarity of roles and responsibilities. Note that two PMO interviewees noted challenges in working with this Directorate. Information from the evaluation suggests that the difficulties stemmed from the fact that this Directorate did not support the P3 model used for the project and had difficulties accepting its role in the project. This information is consistent with a finding in the lessons learned report, which concluded that "when a project embarks on a non-traditional approach such as was employed for the RADARSAT-2 MCP, it cannot be assumed that CSA staff will always be comfortable with the new construct despite established protocols and experience derived from more traditional projects."[20]

[20] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #12: Project Management Functions – Private-Public Partnership).

3.2.4 Effectiveness of Project Management

Finding: *The CSA put in place the necessary project management tools, enjoyed good working relationships with most partners, and generally established good mechanisms for communication and information exchange within the CSA. Project scope changes resulted in long delays and significant additional costs, although this was due to factors outside the control of the CSA.*

As discussed in Section 3.2.1 (*Fulfillment of the Mandatory Requirements for the Management of an MCP*), as a P3, the nature of the CSA's role in managing the RADARSAT-2 MCP was very different from a traditional project management model (i.e., procurement project undertaken by GoC). The CSA provided oversight to the project, which was undertaken by the private sector (i.e., MDA). The project was managed using a small, core team approach, with full-time resources assigned to the PMO and other resources from across the organization providing support when necessary on a part time basis (e.g., EOAU and Communications). While the CSA had appropriate project management tools in place to monitor the progress of the RADARSAT-2 MCP, there were two key issues that resulted in project scope changes and subsequent additional costs and a long delay in the launch of the satellite, both of which were outside of the control of the CSA (a *Force Majeure* situation existed with respect to the bus sub-contract, and a change in launch supplier). These two issues are described in more detail below.

RADARSAT-2 Budget and Schedule

According to the most recent RADARSAT-2 Project Brief (2009), the original cost for the RADARSAT-2 MCP was $322.7M, of which the CSA and MDA were to contribute $242.2M and $80.5M, respectively. A number of modifications were made to the original cost and the final project cost was in the order of $539.6M, with a $433.4M contribution from the GoC ($15.5M from DND and $417.9M from the CSA) and a $106.2M contribution from MDA (see Table 4 for a summary of project costs).[21] In addition, the GoC provided government-furnished equipment and services, including RADARSAT-1 spares ($4.9M), ground support equipment ($12.5M), equipment at the RADARSAT operation facilities of St-Hubert and Saskatoon ($40.0M), and the services of the David Florida Laboratory (DFL) ($2.5M) for a total estimated value of $59.9M of in-kind support.[22]

[21] Canadian Space Agency. *RADARSAT-2 Revised Project Brief.* January 2009.
[22] Ibid.

Table 4. Summary of RADARSAT-2 Major Crown Project Budget (Planned and Actual)

Government Funding ($M)	Original Budget	Revised Budget (October 2004)	Final Budget
Salaries & EBP	2.52	6.26	8.13
PMO Cost	6.64	22.09	17.21
DFL support cost	2.61	2.61	3.23
Early study	5.24	5.24	5.24
Precursor contracts	7.30	7.30	7.30
MA value	217.59	393.57	392.45
Total CSA funding	**241.90**	**437.07**	**433.56**
Total MDA funding	**80.50**	**91.60**	**106.20**
TOTAL project funding	**322.40**	**528.67**	**539.76**

Source: Adapted from the *RADARSAT-2 Major Crown Project Close-out Report.*

This information shows that there was a large variance in the total project costs for the CSA for RADARSAT-2 (a 79.2 percent increase, or $191.1M). Note this does not include the in-kind support provided by the CSA. MDA also saw an increase in the total project costs for the project (a 31.9 percent increase, or $25.7M). While there were a number of changes which contributed to the increased cost,[23] the most significant were related to two major scope changes. As described in the RADARSAT-2 Project Brief, a *Force Majeure* situation existed with respect to the bus sub-contract, which resulted in a change in the bus supplier and a budget increase of $55.8M (CSA costs were $47.1M, MDA costs were $8.7M).[24] Also, as a result of a change in launch supplier, an additional $108M was required. Note that NASA originally was going to provide free launch services in exchange for data (see Section 3.3.4 for details on the NASA agreement).[25] Neither of these issues was under the control of the CSA, nor MDA.

Due to the delays caused by the *Force Majeure,* the subsequent switch in launch supplier from NASA provider to CSA provider, and delays in the launch decision, the project timelines were revised with a new launch date of March 2003 (16 months late). On-going technical issues (e.g., with the SAR payload transmit / receive modules and bus module development) resulted in further delays to the launch date (December 2005). The eventual launch, in December 2007, followed additional delays during the integration and test phase and a second change in launch vehicle. These issues resulted in an overall project delay of six years (see Table 5).

[23] Addition of MODEX ($14.5M, paid by DND); Ground Segment Infrastructure Upgrades ($6.69M); RADARSAT-2 modifications / upgrades ($6.5M).
[24] As per Article 14 of the MA, the events of a *Force Majeure* included, but are not limited to: war, riot, flood, fire, strike, lockout or other labour disputes, the act or omission of any Government or Authority outside of this Agreement, having jurisdiction, and other events that are unavoidable and beyond the Party's reasonable control.
[25] Canadian Space Agency. *RADARSAT-2 Revised Project Brief.* January 2009, page 12-13.

Table 5. Summary of RADARSAT-2 Schedule (Planned and Actual)

Milestone Name	Original Date	Revised Date (October 2004)	Final Date
Mission preliminary design review	February 1999	February 1999	February 1999
Delta mission preliminary design review	--	March 2001	March 2001
Mission critical design review	February 2000	June 2002	June 2002
Spacecraft readiness review	--	December 2004	May 2006
Operations validation review	June 2001	August 2005	September 2007
Launch	**November 2001**	**December 2005**	**December 2007**
Commissioning complete review	March 2002	March 2006	April 2008
Decommissioning review	April 2009	April 2013	April 2015

Source: Compiled with information from the *RADARSAT-2 Major Crown Project Close-out Report*.

In the CSA's opinion, while this was a lengthy delay, "RADARSAT-1 was still operational at the time RADARSAT-2 was launched, so that data continuity has been maintained. Therefore, there was no impact for the data users."[26] Also, while individuals interviewed during the lessons learned exercise categorized the progress of the project as very slow to good, the delays did not seem to affect interviewee's views of the effectiveness of project implementation. Note that those who felt progress was good gave credit to the PMO for completing the project despite the nature and complexity of the project.

Views on Effectiveness of Project Implementation

Overall, PMO interviewees were very positive (6 of 8) about the effectiveness of project implementation, because the project was successfully completed and there was a good PMO. The two other PMO interviewees were not as positive, citing the lengthy delay as an issue. MDA interviewees were fairly positive about project implementation (two positive, one neutral), suggesting that the CSA PMO was effective because the project was ultimately completed. Other CSA interviewees were slightly less positive in this respect, indicating that the PMO did the best they could with what they had; however, there were issues with respect to a long-term vision (e.g., data use), lack of senior management support, lack of clarity around roles and responsibilities, and a lack of resources. Partners were split on this question, indicating that the PMO was good and did what they could with the situation, but that they lacked foresight on certain issue (e.g., data use and security).

[26] Canadian Space Agency. *RADARSAT-2 Major Crown Project Close-out: Presentation to Executive Committee*. 19 March 2009, slide 14.

3.2.5 Success of Private-Public Partnership

Finding: *The CSA and MDA established a good working relationship and there were effective mechanisms in place for communication and information exchange between the two partners, although there were issues with respect to the clarity of the common objectives and the roles and responsibilities of each partner. Views on the overall success of the P3 were mixed, with MDA suggesting that it was a success, because the project was completed and the partners obtained what was desired. However, government stakeholders believe that the P3 was not successful for the GoC.*

As discussed in Section 1.1 (*History of the MCP*), the RADARSAT-2 MCP was a unique partnership between the CSA and MDA. The MA outlined all of the technical and legal details for the project and set out the project objectives and roles and responsibilities of the partners. The primary driver behind this partnership was the development of the EO industry, following a model adopted by the GoC for the commercial communication satellite business.

Level of Clarity of Master Agreement

According to the MA, the CSA "was given the mandate to develop a business arrangement with a private sector organisation to ensure the continuity of service for RADARSAT-1 users and to further develop the EO business in Canada." Further, the "business arrangement was to include the development, construction, launch, and operation of a follow-on satellite and associated ground stations equipment which are to be funded partially by the government and partially by the private sector, and was to include the transfer to the private sector of the CSA related ground support operations and certain assets."[27]

When asked about the clarity of the objectives in the MA, just over half of MDA and CSA interviewees (7 of 12) suggested that they were clear. All three MDA interviewees said they were clear. However, CSA interviewees were split in their opinions. The main issue cited with respect to objectives was that they should have been better outlined and, more specifically, that the common objectives (i.e., the objectives shared between the CSA and MDA) should have been better defined. This information is consistent with one of the findings of the lessons learned report which suggested that "although the overarching objective of the RADARSAT-2 project was clear, from the outset there was a lack of clarity and detail regarding common objectives to guide the two parties (i.e., MDA and the CSA), as defined in the MA. The MA defines in considerable detail the description of the work, the schedules, terms, conditions, subcontracting processes, financial arrangements, and reporting means but it does not adequately define common objectives relating to the potential pressures on project scope, costs, and time."[28]

[27] Canadian Space Agency and MacDonald, Dettwiler and Associates Ltd.. *RADARSAT-2 Master Agreement Between MacDonald, Dettwiler and Associates Ltd.(MDA) and the Canadian Space Agency*, page 1.
[28] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #1: Master Agreement Objectives).

Throughout the various sections of the MA, the responsibilities of both partners are clearly outlined. Just over half of the MDA and CSA interviewees (7 of 13) suggested that the roles and responsibilities of the CSA and MDA were clearly outlined in the MA. These interviewees were mostly representatives of MDA (3 of 3) and the PMO (4 of 7). Representatives of other CSA Directorates were in complete disagreement with this (3 of 3), suggesting that there were too many areas left open to interpretation. This is likely due to the fact that these interviewees were those with responsibilities related to data policy and operations transition — two issues which seemed to have been a challenge during the project. This conclusion was supported by a CSA representative, who suggested that there is an absence of expertise in data policy matters in CSA. However, this discrepancy of views could also be a result of the non-traditional approach to the project and, as suggested in the lessons learned report, "CSA representatives did not always have a clear understanding of what they were permitted to commit to on behalf of the CSA and the Crown" and "in several instances CSA staff was thrust into unfamiliar and uncertain territory due to the private-public nature of the RADARSAT-2 Project."[29] In fact, dealing with this ambiguity was identified by the PMO as the most important value-added skill gained in the course of the project. Interviewees suggested that expertise was gained in the management of a P3, particularly with respect to using / applying a small core-team approach, increased expertise in P3s, and better knowledge of transition planning.

Communication and Information Exchange

As specified in the MA, there were established mechanisms for information exchange and communication between MDA and the CSA. Documents and information from interviewees showed that the following mechanisms were in place:

- weekly PMO / MDA meetings;
- monthly MDA / CSA meetings;
- MDA / CSA Senior quarterly reviews;
- the OTPG technical reviews;
- CSA / MDA technical meetings;
- CSA monthly reports; and
- MDA monthly reports.

These means were cited by interviewees as a way of obtaining information on the project and they also suggested that reporting requirements were met, although four interviewees (4 of 17) suggested the reports were not always timely. Despite this, interviewees generally felt that they had enough information available to them throughout the course of the project (i.e., to make decisions, identify and resolve issues) (11 of 17). This information is not consistent with the lessons learned report which concluded that "several sections of the CSA and OGDs observed that there was insufficient access to all of the requisite project and procurement documentation."[30]

[29] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #12: Project Management Functions – Private-Public Partnership).
[30] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #3: Access to Project Information).

In addition to these formal mechanisms, interviewees (particularly the PMO) also suggested that informal methods were used to communicate and share information between the CSA and MDA (e.g., e-mail and ad hoc meetings). Most interviewees (14 of 16) believe these mechanisms were very or moderately effective and that overall MDA and the CSA worked well together. This is consistent with the lessons learned report, which concluded that "one common theme through the life of the project was the exceptionally strong level of communications and professionalism exhibited between the CSA and MDA teams."[31] The interview and focus group information from the lessons learned exercise also suggested that overall the working relationship between MDA and the CSA was good, although strained at times due to issues that arose with the launch and transition to operations. This is similar to the opinions of two interviewees who suggested that OTPG did not function well.

Views on the Success of Private-Public Partnership

While the working relationship between the CSA and MDA was viewed as good, MDA and GoC stakeholders viewed the overall success of the P3 differently. MDA rated the success of the P3 very positively (4 of 4), indicating that it was successful because all partners obtained what was desired (i.e., satellite was built, launched and all assets transferred to the private sector). Most GoC interviewees were either neutral or negative about the success of the P3 (9 of 9 interviewees from other CSA Directorates, 3 of 4 partners / users, and 6 of 9 PMO interviewees). These ratings were related to two key issues. The first being the fact that many interviewees, for various reasons, did not support the P3 approach (18 of 26) and suggested, for example, that the CSA had limited control over the project; that the GoC absorbed all of the risk and paid for most of the system; and that, in the end, the GoC does not own the system and therefore the project was not a good investment. Note that a CSA representative indicated that the GoC did not absorb all of the risk; rather it was absorbed by the industry.

The second issue is related to the fact that some interviewees do not believe the project met its objectives (7 of 26), for example, objectives related to commercialization. This opinion is consistent with the evaluation findings (see Section 3.3 *Project Impact* for details).

Therefore, while the CSA and MDA had a good working relationship, had effective mechanisms in place for working together, and ultimately completed the project, the P3 was not viewed by GoC stakeholders as a good investment for the GoC. Information provided by the CSA, however, shows that the GoC saved money by using the P3 approach, as MDA incurred some of the cost for RADARSAT-2 (the costs to the GoC for RADARSAT-2 and RADARSAT-1 were $433.56M for and $621.3M, respectively). In addition, the GoC is not responsible for the cost of the on-going operation of RADARSAT-2 (for comparison purposes, the costs to the GoC for the operation of RADARSAT-1 are $78.2M). While data shows that the costs for RADARSAT-2 were less than RADARSAT-1, a full cost-effectiveness analysis would be required to determine whether RADARSAT-2 proved to be a better investment for the GoC than RADARSAT-1 (i.e., an analysis of the cost of both systems against the actual benefits of both systems). This kind of

[31] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #4: Stakeholder Communications).

analysis cannot yet be done, as RADARSAT-2 has not been in operation long enough. A cost-effectiveness analysis should be completed as part of the evaluation of the on-going operation of RADARSAT-2, which will be conducted in a few years time.

3.2.6 Successful Close-out of the Major Crown Project

Finding: *Apart from the program evaluation and payment for the launch, the CSA has completed the close-out of the MCP. However, challenges with the transition to operations were encountered mainly because of questioning of the CSA's role in the ongoing operation of RADARSAT-2, as defined in the MA.*

Project close-out refers to the transition of the RADARSAT-2 MCP from the development phase to the operation phase. This requires the settling of all contracts, asset transfers, financial pay-outs, the closure of the PMO, the archiving of records, and the transfer of operational responsibility to an operations group. The transition to operation began in February 2007 and was completed in December 2008, with amendment number ten to the MA. The operations phase officially began on April 24, 2008 following the Commissioning of the spacecraft. The operations phase is the responsibility of two CSA groups: Operations, for the management of the MA, and the Government Order Desk and Space Technologies, for the management of the Government Data Allocation as per the transition plan. Information provided in documents and by the PMO indicates that the close-out has been completed, with the exception of the evaluation and the payment to Starsem for the launch (see Table 6 for a summary of close-out activities).

Table 6. Summary of Close-out Activities

Close-Out Activity	Status
Dismantling of the PMO	• All resources from the PMO have been reassigned. • As of March 31st, 2009, there was no longer a PMO, however, the deputy project manager remains involved with final activities (e.g., the evaluation). • The last SPAC was held on June 19 2009.
Financial close-out	• The financial close-out is complete except for the final $120K earmarked for the evaluation exercise. • All payments to MDA have been made except for the remaining payments to Starsem for the launch which is using PAYE funds.
Contract close-out	• The MA will remain in effect after the MCP close-out; however, there was a close-out of the MA for the development phase with the Amendment #10 of the MA. • All payments to MDA have been made except for the remaining payments to Starsem for the launch which is using PAYE funds.
Archiving of project-related records	• Archives have been prepared in accordance with the CSA Policy on Records Classification.
Transfer of assets	• Assets defined within the MA have been transferred to MDA.
Transition to operations	• The PMO transferred the responsibilities to the two sectors responsible for the operation phase within CSA and MDA took over some operation activities from the CSA.

While the close-out has essentially been completed, the lessons learned report concluded that the "handling of operations transition issues between SatOps and MDA could have been managed more effectively." The main issue was related to the fact that some sectors of the CSA questioned their planned role in operations management. This resulted in a great deal of time being dedicated to the issue, which "led to confusing messages and apparent resistance to the principles negotiated within the MA."[32] This finding is consistent with information provided by MDA and the CSA in interviews, which suggested that there were challenges with the transition to operations, mainly because of the questioning of CSA's role in the operation of RADARSAT-2.

3.3 Project Impact

3.3.1 Continuation of SAR Canadian Leadership

Finding: *RADARSAT-2 has helped continue Canadian leadership in the satellite application of SAR technology, although launch delays allowed the launch of competing systems ahead of RADARSAT-2.*

In the mid-1990s it was generally believed that the EO sector was on the verge of phenomenal commercial growth, as had been witnessed in the commercial satellite communication sector. This presented an enormous opportunity for Canada to gain leadership in a new growth area through the development of SAR.

In support of this potential market, a major thrust of the 1994 LTSP-II was to exploit this opportunity through the RADARSAT Program, with the main objective being to produce and operate the most advanced SAR-based EO satellites in the world. The four components of this strategy were the utilization of state-of-the-art SAR technology, the support of Canadian industry in worldwide commercialization, the development of value-added applications, and the development of international partnerships.

Canadian involvement in SAR began with RADARSAT-1 (launched in 1995) with an expected five-year mission. RADARSAT-2 was to provide both data continuity and a technical advance over the first satellite. Technical requirements were to include C-Band Imaging, 3-metre resolution modes, full polarization capability, and routine left and right looking. At the end of the project, CSA's technical team produced a technical acceptance report which indicated that all performance objectives (i.e., technical specifications) had been met.[33] This was also confirmed by information provided by systems engineers, both in the lessons learned focus group and in interviews, who confirmed that RADARSAT-2 met all technical requirements.

[32] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #11: Operations Transfer – MDA and Space Operations).
[33] Canadian Space Agency. *RADARSAT-2 Revised Project Brief.* October 2004.

The systems engineers interviewed also indicated that the system represented a technical advance over RADARSAT-1 capabilities. A recent study on Canada's position in SAR technology suggested that RADARSAT-2 was a technical advance over RADARSAT-1 and has much more power and capability (i.e., SAR on-time). The study also notes that there are now similar systems in operation, although perhaps with less powerful capabilities.[34] Other space agencies have been involved in the civilian application of SAR technology and have launched their own satellites (e.g., TerraSAR-X and Cosmo SkyMed). All four interviewees that were asked about Canada's position in SAR technology confirmed this, suggesting that RADARSAT-2 contributed to maintaining Canada's leadership in that respect, but that there were similar systems offering competition with RADARSAT-2.

3.3.2 Contribution to the Earth Observation Business in Canada

Finding: *The project may result in a profitable investment for MDA; however, there is little evidence available to determine whether the value-added sector will benefit, although it may be too early to see results.*

As previously discussed, one of the key objectives of the RADARSAT-2 MCP was to develop a business arrangement with a private sector organization to ensure the continuity of service for RADARSAT-1 users and to further develop the EO business in Canada. The achievement of this objective was examined from two perspectives: the growth of the prime contractor (i.e., MDA), and the growth of the value-added industry.

Growth of MDA

In its original business plan for RADARSAT-2, MDA estimated that their total market potential was important. In the last update of the business plan, the analysis suggested that the market did not develop as aggressively as expected and was affected by other direct competition which did not previously exist (e.g., TerraSAR-X and Cosmo SkyMed) as well as by constraints placed on data distribution by the operating license issued to MDA / GSI by the Department of Foreign Affairs and International Trade (DFAIT).[35]

The information from the business plan analysis is consistent with findings from the lessons learned report, which indicated that "market conditions eroded and the forecast for commercial opportunities is now less promising than that conveyed in the MDA proposal and business plan."[36] However, the latest information provided by MDA in interviews and in MDA financial reports, suggests that the business may still be profitable.

In its 2008 third-quarter report, MDA indicated that it was making progress in signing sales commitments for RADARSAT-2 imagery, although that those sales were not yet having a

[34] Werle, D. & D. Ball. *Synthetic Aperture Radar Technology in the Era of RADARSAT-2: International Context and Background Information. DB Geoservices Inc. Report to the Canadian Space Agency, Contract No. 28 / 7005542.* March 2008.
[35] Canadian Space Agency. *Evolution of the RADARSAT-2 Business Plan.* April 2009.
[36] Lansdowne Technologies. *CSA RADARSAT-2 Project Lessons Learned Exercise.* December 2008 (Lesson Learned #5: Commercialization of the Earth Observation).

significant impact on reported results.[37] This was confirmed by MDA interviewees, who qualified the P3 an overall success, suggesting that MDA will be a profitable player and will see growth in the market. Another MDA interviewee indicated that MDA will recuperate its investment, although it may take longer than anticipated because of the higher costs for the system. Further, MDA's 2008 Annual Report showed a small growth in earnings for MDA / GSI in their information products business line, which would include RADARSAT-2 products. Although, this likely also includes other earnings (i.e., from RADARSAT-1) and therefore, does not give a true picture of the actual profit from RADARSAT-2.

In addition, through the expertise it developed on the RADARSAT-2 project, MDA was able to acquire contracts for other space programs. For example, this expertise allowed MDA to acquire work on several related missions, such as RapidEye (a $52.5M project with 35 percent Canadian content) and Cassiope (an $111M project with 73 percent Canadian content).[38]

Growth of the Value-Added Industry

CSA interviewees agreed that the RADARSAT-2 MCP contributed to the EO business, mostly because it resulted in growth for MDA (6 of 11). Interviewees believe that little benefit was provided to the value-added industry (7 of 11), which was one of the key objectives of the project.

In its bid proposal for the RADARSAT-2 project, MDA put much emphasis on the development of the value-added sector, suggesting that they would be able to develop strategic partnerships to take advantage of the marketplace. These partnerships, in combination with support provided both by the CSA and MDA for applications development, were expected to benefit the value-added sector. It is unclear exactly how these activities were to contribute to the development of the value-added industry however; and there is limited information to assess the impact of RADARSAT-2 on this industry (i.e., there is no industry data available, MDA does not report on its involvement with the value-added industry). Recent research suggests there is little commercial activity in the EO sector. A 2004 study on the state and health of the European and Canadian EO service industry concluded that governments and other public bodies are the dominant customers (for EO products and services) with 78 percent of products marketed towards this sector.[39] Further, a more recent report (2008) citing trends in the EO industry suggested that governments remain the largest customers of commercial EO data.[40]

The CSA uses two programs, the Earth Observation Application Development Program (EOADP) and the Science and Operational Applications Research Program (SOAR) to assist industry and researchers in the development of new applications for RADARSAT-2 data. The EOADP was conceived in 2000 and was designed to foster the development of EO applications,

[37] MacDonald, Dettwiler and Associates. *Third Quarter Report 2008 - Three and Nine Months Ended September 30, 2008*.
[38] MacDonald, Dettwiler and Associates Ltd. *RADARSAT-2Master Agreement: Industrial and Regional Benefits Report.* June 2008.
[39] VEGA Group PLC. *The State and Health of the European and Canadian EO Service Industry (Technical Report).* September 2004.
[40] Futron Corporation. *Futron's 2008 Space Competitiveness Index. A Comparative Analysis of How Countries Invest and Benefit from Space Industry.* 2008.

using data provided by RADARSAT-2. The goal of the program was to assist private sector firms in the development of commercial applications of RADARSAT-2 data. Information on the CSA website shows that 26 projects have been funded through this program. The SOAR program was a joint partnership between the CSA, MDA, and CCRS to allow researchers worldwide to explore possibilities inherent within RADARSAT-2 data. As with EOADP, this program is funded by the CSA. According to a CSA representative, there have been 192 projects funded through this program to date. These programs are expected to impact the value-added sector; however, because RADARSAT-2 data has only been available for a short period, there is no information available to determine whether these programs are having an impact in that respect.

The lack of data on the value-added industry and on the possible benefits of the EOADP and SOAR program to the value-added industry makes it impossible to assess whether there has been growth in the industry as a result of the RADARSAT-2 MCP. Although given that RADARSAT-2 has been operational for just over one year now, it may be too early to determine whether there have been any impacts.

3.3.3 Industrial and Regional Benefits

Finding: *Most industrial and regional benefit objectives were met, although regional distribution targets in two regions fell short of established targets.*

As an MCP, the construction of RADARSAT-2 was expected to provide benefits to Canadian industry as well as subsequent benefits through acquired knowledge. The MA (Section 20.2) outlined the expected Canadian content and regional distribution of contract work. The distribution could either be achieved as a percentage of total work or as a dollar value. Overall Canadian content was set at 65 percent of project value, or $193.7M, while MDA was contractually committed to 50 percent Canadian content, or $149M. In the end, MDA was able to surpass its goal with an overall content of 59 percent. Actual Canadian content was 58.9 percent (below target), mainly due to the switch of bus supplier from Orbital Sciences of the United States to Alenia of Italy. This switch was necessitated by the inability of Orbital Sciences to transfer the required technology.[41]

In the MA, commitments were made to provide a certain amount of work across five regions, with British Columbia having the highest commitments at 54.73 percent and the Atlantic and Prairie provinces having the lowest commitments, each with 2.73 percent (see Table 7). At the outset of the project and in the plan developed for regional distribution, MDA identified the Prairie and Atlantic regions as areas of concern for meeting the commitments. It therefore worked with Orbital Sciences, the original spacecraft bus supplier, to identify qualified suppliers in these regions.[42]

[41] MacDonald, Dettwiler and Associates Ltd. *RADARSAT-2Master Agreement: Industrial and Regional Benefits Report.* June 2008.
[42] MacDonald, Dettwiler and Associates Ltd. *RADARSAT-2Master Agreement: Industrial and Regional Benefits Report.* June 2008, page 6-1.

Table 7. Summary of Industrial and Regional Benefits

Region	Regional Benefits			
	Commitment		Actual	
British Columbia	54.73%	$110.1M	59.14%	$140.1M
Prairies	2.73%	$5.5M	0.30%	$0.7M
Ontario	9.94%	$20.0M	10.22%	$24.2M
Quebec	29.87%	$60.1M	29.89%	$70.8M
Atlantic	2.73%	$5.5M	0.46%	$1.1M
Total	**100.00%**	**$201.2M**	**100.00%**	**$236.9M**

Information in the IRB Report showed that the project met its commitments in three of the five regions, and actually exceeded commitment values in these regions. However, commitment values were not met in the two smallest regions (the Prairies and Atlantic). According to the report, this was due to the change in bus supplier from Orbital to Alenia, which meant that the planned benefits to these regions via Orbital were not realized. MDA indicated that it was not possible to replace all of this work through the Alenia subcontract.

In addition to ensuring a distribution of work across the five regions, MDA committed to ensuring small business participation in the project. Although no specific targets were set, MDA required major subcontractors to provide Small- and Medium-Sized Enterprises (SMEs) with an opportunity to be included on the bidders list for all procurements. MDA also required these companies to report to MDA on the level of SME involvement in their contract, which was reported to the CSA, via the quarterly reports. Direct Canadian SME benefits totalled $6.3M, with the Quebec region receiving the highest proportion of that dollar value (see Table 8). This is due to the fact that a large majority of the dollar value in Quebec ($5.277M) was reported by MDA Montreal (Electro Magnetic Science Technologies Ltd).

Table 8. Benefits to Small- and Medium-Sized Enterprises

Region	SME Benefits
British Columbia	$7K
Prairies	$124K
Ontario	$778K
Quebec	$5,342K
Atlantic	$71K
Total	**$6,322K**

3.3.4 International Objectives

Finding: *While there are some international agreements in place for RADARSAT-2, its primary international objective to have NASA launch the satellite was not realized, due to a decision by NASA.*

As part of the RADARSAT-2 MCP, the CSA, in conjunction with its private sector partner, intended to negotiate an agreement with NASA for the launch of RADARSAT-2 in exchange for data. NASA had agreed to this "Arrangement for Enhanced Co-operation in Space between NASA and CSA,'' signed in May 1994. This document (the "Clark-Evans Agreement") was an

agreement in principle to co-operate on several undertakings including RADARSAT-2. Information in the 2009 RADARSAT-2 Revised Project Brief indicates that NASA informed the CSA in December 1998 that it would not honour the Agreement, citing reasons related to the commercial nature of the satellite and the fact that its enhanced performance would be a major competitor to US industry.[43]

Project documentation indicates that there were a few other international agreements / arrangements put in place for RADARSAT-2:

- In 1999, MDA set a commercial arrangement with Orbimage (which provided funds to MDA in exchange of exclusive worldwide rights to the data). However, in 2003, MDA bought back all data rights from Orbimage which are with MDA's subsidiary GSI.
- In 2003, DFAIT approved a commercial agreement between GSI and Norway. This agreement allows GSI to receive payment for pre-purchase of RADARSAT-2 data by the Norwegian Space Center.[44]

This document also notes that MDA / GSI continue to market to regional partners and network stations, and now that the satellite is operating successfully, it is expected that additional agreements with international partners will be implemented.

[43] Canadian Space Agency. *RADARSAT-2 Revised Project Brief.* January 2009.
[44] Canadian Space Agency. *RADARSAT-2 Major Crown Project Close-out: Presentation to Executive Committee. 19* March 2009, slide 12.

3.3.5 CSA's Readiness for the Optimal Use of Data Allocation by Other Government Departments

Finding: *The CSA is not accountable for the use of RADARSAT-2 data by OGDs; however, information from the evaluation suggests that the CSA has been successful in providing access to RADARSAT-2 data and in undertaking activities to facilitate the use of data by OGDs. Whether any benefits are generated as a result of the acquisitions is dependent on whether OGDs use the data.*

The planned number of scenes to be acquired by each department is outlined in the CSA's Data Utilization Management Plan (developed annually). EOAU tracks RADARSAT-2 scene acquisition (i.e., images) by OGDs each month and compares that to the plan. This data showed that for the first year of operation, six OGDs estimated that they would acquire a total of 14,357 scenes, 90 percent for Environment Canada (EC) (10,502 scenes) and DND (2,651 scenes). In the first year of operation, OGDs actually acquired only 64 percent (9,237) of the scenes estimated, for a variance of -5,120 scenes. EC acquired the largest number of scenes (4,601, 5,901 below target). While many departments did not meet their planned acquisitions, a few which did not plan any acquisitions actually did receive scenes in the first year of operation (see Table 9).

The variance in planned versus actual scene acquisition can be explained by a number of factors. According to information provided by the CSA, the estimates in the Data Utilization Management Plan were developed before the launch of RADARSAT-2. Because of the delay in putting the processing contract in place after the launch, the CSA revised the estimated number of scenes to be obtained to 10,000. Therefore, the actual number of scenes acquired fell only slightly short of this revised estimate (9,237 versus 10,000). The processing contract was also the reason why the Canadian Ice Service (CIS) fell short of its estimates, as that organization continued to use data from RADARSAT-1 until the processing contract was put in place. Information from interviewees also suggested that DND has not yet met its planned acquisitions because its receiving stations (i.e., the Polar Epsilon Project) are not yet operational. Note that information provided by the CSA on the use of RADARSAT-1 data shows an increase in the acquisition of data from RADARSAT-2 compared to RADARSAT-1.[45]

[45] The data set for provided RADARSAT-1 and RADARSAT-2 are different and therefore a full analysis of the data acquisition was not completed, however it does appear that RADARSAT-2 data acquisition in the first year of operation is higher than RADARSAT-1 data acquisition between 1997 and 2008.

Table 9. Number of Scenes Planned Versus Acquired, by Other Government Departments

Department	Planned scenes (2008-2009)	Actual scenes acquisitions (2008/2009)[46]	Variance
Agriculture and Agri-Food Canada	159.0	50.3	-108.7
Canadian Space Agency	634.0	1,011.2	377.2
Department of National Defence	2,651.0	1,465.5	-1,185.5
Canadian Ice Service (EC)	10,502.0	4,601.0	-5,901.0
Department of Foreign Affairs and International Trade	0.0	0.0	0.0
Department of Fisheries and Oceans	0.0	679.1	679.1
Indian and Northern Affairs Canada	26.0	0.0	-26.0
Natural Resources Canada	277.0	1,290.8	1,013.8
Parks Canada Agency	108.0	12.0	-96.0
Public Safety Canada	0.0	43.8	43.8
Statistics Canada	0.0	37.9	37.9
Government of Canada	0.0	45.9	45.9
Total	**14,357.0**	**9,237.5**	**-5,119.5**

Sources: *Data Utilization Management Plan* and *Monthly Utilization Reports* from SatOps.

With respect to the use of RADARSAT-2 data, interviewees suggested that the CSA is not ultimately accountable for how OGDs use the data. However, the majority of interviewees (10 of 13) indicated they felt that the CSA was in a position to ensure that OGDs are ready to use the data.

The CSA has put mechanisms in place to ensure that OGDs receive RADARSAT-2 images, and has undertaken specific activities to raise awareness of the potential uses of RADARSAT-2 data and to facilitate the use of images. As summarized in the User Readiness Report, the CSA has developed several printed or electronic publications to inform the EO community about preparations for RADARSAT-2. EOAU has also presented several documents in PowerPoint format to the EO community at regional, national, or international events. EOAU has also disseminated information on EO issues via its *EO-Express*, a bilingual and free e-newsletter. The newsletter is sent to over 2,250 Canadian and international subscribers and EO community partners.

Also, the CSA funds the Government-Related Initiatives Program (GRIP), which was established in 2000. The program was designed to help foster the use of Canada's space resources by federal government departments. According to the user-readiness report "over 25 GRIP projects with a lifespan of three years and an average contribution of $260K have been organized." Several of these projects focused specifically on applications for RADARSAT-2.[47] It is hoped that these projects will lead to the operationalization of applications which will foster the use of RADARSAT-2 data by OGDs.

[46] Planned scenes do not take into account the sharing of images with OGDs. The actual scene acquisition includes acquisitions that are shared with OGD. This could account for some of the variance in the planned and actual scenes.
[47] Canadian Space Agency. *RADARSAT-2 User Readiness and Preparations Report.* November 2008.

With respect to receipt of images, the CSA currently has an arrangement in place to cover the costs of processing RADARSAT-2 data for OGDs.[48] While this arrangement is now in place, partners / users were critical of the CSA in this respect because of the timing of this arrangement. RADARSAT-2 became operational in April 2008 and the arrangement for processing was not put in place immediately. According to information provided by CSA, the data processing arrangement could not be approved by the Government until the possible sale of MDA's Space Missions Division to Alliant Techsystems' (ATK) was resolved. To address this issue, the CSA negotiated an interim agreement with MDA to provide processing services.

The CSA has also been working with a number of OGDs to put in place MOUs to govern the receipt and use of RADARSAT-2 images. At the time of the evaluation, only one of eleven MOUs had been signed. The CSA indicated that one of the main reasons for not having many MOUs signed relates to the fact that OGDs require clarification of the terms and condition of the data policy to which they must adhere, particularly with respect to the End-User License Agreement (EULA). OGDs have received RADARSAT-2 images, which suggests that the lack of a signed MOU does not prevent the receipt of images. However, because the MOU also contains OGD reporting requirements, an unsigned MOU could result in issues with respect to OGDs reporting on the use of images. Information on the use of images will be critical in evaluating the on-going success and cost-effectiveness of the RADARSAT-2 Program.

Overall, the CSA has been successful in providing OGDs access to RADARSAT-2 data and has also facilitated their use of that data. Ultimately, the question of whether any benefits will be generated as a result of the acquisitions is dependent on whether OGDs use the data. A user readiness study, completed in 2008, gathered information from 13 departments and concluded that OGDs are at varying levels of readiness, with the marine-based departments and DND more advanced in this respect than land-based departments (see Table 11). Five of the thirteen OGDs included in the study confirmed that they are either in the research and development phase, are investigating potential uses for the data, or are building their capacity. One confirmed that it was prepared, but faced funding issues and another confirmed that it is not well-prepared due to internal issues (e.g., lack of funding or expertise). One confirmed that they do not plan to use the data. The two biggest users interviewed for the evaluation (i.e., DND and EC) confirmed that they are well-prepared and are already using RADARSAT-2 data.

The User Readiness Report also provided some insight into the barriers for OGDs in using RADARSAT-2 data, including:

- Added complexity of the new RADARSAT-2 modes (compared to RADARSAT-1);
- Lack of knowledge of quantitative information extraction potential in the new RADARSAT-2 data modes;
- Lack of awareness of data ordering procedures;
- Undefined conflict resolution rules; and

[48] DND and EC have contributed funding to this arrangement for the costs of data processing for their organizations.

- Possible processing costs (for government users), once the applications become operational.[49]

Information from the evaluation also suggests that the current policies surrounding the use and sharing of data is a key barrier to the use of RADARSAT-2 data. OGDs are bound by licensing agreements, which prevent the sharing of information (e.g., between Canada and United States). Note that this may be perception, as the data policy for RADARSAT-1 also placed restrictions on how OGDs could share the data.

It is likely too early to determine whether these barriers will prevent OGDs from optimally using RADARSAT-2 data (i.e., benefits). The actual uses of and benefits from RADARSAT-2 would have to be assessed in a few years time.

Table 10. Summary of Other Government Department Readiness to Use RADARSAT-2 Images

Department	Level of Readiness
Canadian Ice Service IS (EC)	Well-prepared to use RADARSAT-2 data (largest user of RADARSAT-2).
Department of National Defence	Well-prepared to use RADARSAT-2 data.
Canadian Coast Guard (Department of Fisheries and Oceans)	Well-prepared to use RADARSAT-2 data (no adaptations necessary to switch over to RADARSAT-2).
Transport Canada	Integrated Satellite Tracking of Polluters (ISTOP) is already operational. Other than ISTOP, Transport Canada will have limited use for RADARSAT-2.
Public Safety Canada	Well-developed capacity to use data.
Canada Centre for Remote Sensing (NRCan)	Prepared to use data, but have funding barriers.
EC (Canadian Wildlife Service)	Building RADARSAT-2 readiness.
Statistics Canada	In research and development phase.
Agriculture and Agri-Food Canada	In research and development phase.
Centre for Topographic Information Sherbrooke (NRCan)	Potential uses under investigation.
Canadian Forest Service (NRCan)	Potential uses under investigation.
Parks Canada Agency	Not well prepared due to lack of expertise.
Indian and Northern Affairs Canada	No plans to use data.

Source: *RADARSAT-2 User Readiness and Preparations Report.*

[49] The CSA pays the cost for processing for applications development. Once the application is operational, the respective department is responsible for paying the cost of processing.

3.4 Other Issues

3.4.1 Best Practices and Lessons Learned

Between 2006 and 2008, the CSA completed a lessons learned exercise, which was conducted primarily to collect information to improve project management for future, similar projects. In completing the lessons learned exercise, a series of in-depth interviews and focus groups were conducted with numerous project stakeholders. This exercise resulted in the identification of 18 lessons learned, covering a wide range of topics, including project management, communications, risk management, the MA, and project objectives.

Because this exercise was so comprehensive and resulted in the identification of a series of lessons learned, the evaluation did not attempt to duplicate the exercise (i.e., collect new information). Rather, where the lessons learned provided evidence to support evaluation findings, it was incorporated into the evaluation report (see Appendix E for a summary of the lessons learned).

The evaluation did ask partners / users what should be done differently for future projects; however, only four partners / users provided suggestions. Two suggested that they would not recommend the P3 approach again, one suggested that better financial arrangements need to be established with partners, and one suggested that partners need to be consulted at the outset of a project.

4.0 Overall Conclusions and Recommendations

This section provides the overall conclusions and recommendations from the evaluation of the RADARSAT-2 MCP.

Project Relevance

The RADARSAT-2 MCP is consistent with the mandate of the CSA, as outlined in the *Space Agency Act*, to be involved in programs and projects related to the development and application of space technology, as well as the procurement of such systems. In addition, the MCP was designed specifically to address federal government priorities, which were laid out in the LTSP-II. This plan emphasized the commercial potential of the EO sector, which was believed to be on the verge of dramatic growth, much like that experienced in the development of the commercial satellite communications sector. The LTSP-II also emphasized the importance of creating a partnership with a private sector firm that would gain the capabilities to sustain the EO sector. Thus, the **RADARSAT-2 MCP was designed, not only to provide data continuity for RADARSAT-1, but also to develop the capacity of the private sector for the purpose of developing the EO sector, thereby addressing the priorities of the federal government to develop that sector**.

Project Implementation and Management

Overall, the **CSA was effective at managing and implementing** the RADARSAT-2 MCP, although the evaluation identified **a few opportunities for improving the management and implementation** for future projects.

The **CSA put in place the necessary project management tools and fulfilled the mandatory requirements** as per the TBS policies, including the establishment of a project accountability structure, a project management framework and management principles, and a project profile and risk assessment. The CSA also defined and updated the project scope, as required, and established a SPAC to provide a forum for information sharing between interested departments. Due to the nature of the project (i.e., the CSA was providing oversight), a formal project performance management system was not put in place; however, formal reporting requirements were established.

The CSA also put in place partnerships to provide support to the project, with DND, CCRS, and PWGSC being the key partners. The CSA involved these partners from project inception and **overall the CSA was effective at managing the partnerships**, although there was a lack of clarity with respect to roles and responsibilities with one partner.

There were also **security challenges**, which seem to be related to the fact that not all security issues were identified at the outset of the project and according to one partner, it was ultimately challenging to ensure that appropriate security measures were implemented. Security issues were also challenging due to the new RSSSA which was developed at the same time as the RADARSAT-2 project. Indeed, the RSSSA regulations were adopted in April 2007 just prior to the launch of RADARSAT-2.

> **Recommendation #1**: *The CSA must ensure that issues such as security are given much more priority and are addressed at the outset of the project.*

Within the CSA, the **PMO established good working relationships with other CSA Directorates and put in place effective mechanisms for communication and information exchange**. The PMO weekly meetings were the main vehicle for communication and information exchange and the PMO involved representatives of other CSA Directorates as necessary. According to interviewees, the PMO was open and transparent and provided good information and communications, although one Directorate suggested that it was not sufficiently proactive.

> **Recommendation #2**: *For future projects, the CSA should model the success of the PMO during the RADARSAT-2 MCP in ensuring openness and transparency and establishing good communications both with partners and internal CSA Directorates.*

There were difficulties between the PMO and one CSA Directorate, which stemmed from the fact that this Directorate did not support the P3 model used for the project and had difficulties accepting its role in the project (see recommendation # 5).

Overall, the CSA put in place the necessary project management tools, enjoyed good working relationships with most partners, and generally established good mechanisms for communication and information exchange within the CSA.

The project experienced major scope changes which resulted in long delays and significant cost increases. In the end, the satellite was launched six years later than originally planned, with a total cost increase of $191.1M for the CSA and $25.7M for MDA. The delays and increased cost were the result of two key issues; a *Force Majeure* due to the need to change the bus supplier and a decision by NASA to back out of the launch agreement. This resulted in the need for CSA to pay for the launch supplier. It is important to emphasis that both of these issues were outside of CSA's control and therefore, did not diminish CSA's effectiveness in implementing the project. In fact, those interviewed commended the work of the PMO given the difficult and complex circumstances of the project.

With respect to the P3, **the CSA and MDA established a good working relationship and there were effective mechanisms in place for communication and information exchange between the two partners**. The MA provided the technical and legal details for the project and set out the project objectives and roles and responsibilities of the partners. However, the **agreement was not clear in outlining the common objectives of the two parties or in**

establishing clear roles and responsibilities for each partner, particularly with respect to the use of data and operations transition.

> **Recommendation #3**: *For future projects, the CSA must ensure that the common objectives between itself and business partners as well as the roles and responsibilities of all partners are clearly articulated early in project documentation.*

Views on the overall success of the P3 were mixed, with MDA suggesting that it was a success, given that the project was completed and the partners obtained what was desired. However, some government stakeholders believe that the P3 was not successful for the GoC, primarily because the CSA had insufficient control over the project, the GoC absorbed all of the project risk and paid for most of the system, and in the end the GoC does not own the system. A CSA representative indicated that the GoC did not absorb all of the risk; rather it was absorbed by MDA. While the costs for RADARSAT-2 were less than that of RADARSAT-1, **a full cost-effective analysis would have to be conducted to determine whether this model was the most beneficial to the GoC**.

> **Recommendation #4**: *The CSA should conduct a cost-effectiveness analysis to determine whether the savings generated by using the P3 model resulted in similar benefits to the GoC to those resulting from RADARSAT-1.*

The CSA has completed the close-out of the RADARSAT-2 MCP, with the exception of the evaluation and the final payment to MDA for the Starsem launch. A final close-out submission will be made to TBS in the fall of 2009. The evaluation identified issues with respect to the implementation of the transition plan (i.e., moving from development to operations) associated with **questioning of the CSA's role in the ongoing operation of RADARSAT-2 as defined in the MA**.

> **Recommendation #5**: *For future projects, the CSA must ensure that the CSA's role is clearly defined at the beginning and that all CSA representatives are comfortable with that role and accept their responsibilities in fulfilling that role.*

Project Impact

While the CSA was successful in implementing the project, the evaluation showed that the project **has fallen short of reaching some of its key objectives**, particularly with respect to developing the EO sector.

One of the objectives of the project was to maintain Canada's position as a leader in SAR technology. The evaluation found that RADARSAT-2 was a technical leap from RADARSAT-1 and that the project helped continue Canadian leadership in the satellite application of SAR technology, particularly because of its SAR on-time capabilities. However, **launch delays prevented Canada and Canadian industry from being first to market with a new generation of commercial SAR offerings**. By the time RADARSAT-2 was launched, there were other similar systems in operation, although perhaps with less powerful capabilities.

The RADARSAT-2 MCP also aimed to develop the EO sector, much like the commercial satellite communications sector had been developed. Information from the evaluation showed that the **EO market did not expand as expected** and, over the course of the project, MDA reduced its estimated market potential from $1,224M to $267.5M, a significant decrease. Although the estimated market potential for RADARSAT-2 declined, the **project may result in a profitable business for MDA**. Note that the CSA recognizes that the original intent of the MCP to develop the EO business did not materialize as expected. As a result, the CSA is moving forward with a next generation satellite with a different model.

The project was also successful in developing MDA's expertise in the EO sector and, as a result of its participation in RADARSAT-2, MDA was able to acquire a number of other contracts for other space programs. With respect to the value-added industry, it was not clear exactly how or to what extent this sector was expected to benefit. There is **little evidence available to determine whether the value-added sector has benefited**, although it may be too early to see results.

> **Recommendation #6**: *Because the benefit to the value-added sector was a critical factor in the success of RADARSAT-2, the CSA needs to establish appropriate measures to determine the impact of RADARSAT-2 on the value-added sector.*

Overall, the project objective was to have 65 percent Canadian content, with MDA contractually committed to 50 percent. In the end, the project fell short of the 65 percent target (58.9 percent), mainly due to the change in bus supplier, while MDA was able to surpass its commitment (59 percent). With respect to regional distribution targets, **the project fell short in reaching the targets in the Prairie and Atlantic regions**. Again, the achievement of these targets was affected by the change in bus supplier, as the planned benefits to these regions via the original bus supplier were no longer a possibility**.**

The **primary international objective of developing a partnership with NASA to launch the satellite in exchange for data did not materialize** due to NASA's decision to cancel the agreement that was in place.

One of the objectives of the RADARSAT-2 MCP was to ensure data continuity for the users of RADARSAT-1. The project achieved this objective by launching and commissioning the satellite while RADARSAT-1 was still operational and **OGDs are now obtaining scenes from RADARSAT-2**. The **CSA has also helped facilitate the use of RADSARSAT-2 data** by undertaking promotion and communication on the potential uses and benefits of the data, by covering the costs of data processing for OGDs, by supporting applications development through GRIP, and finally, by working to put MOUs in place with OGDs to govern the receipt and use of data.

> **Recommendation #7**: *Because the long-term success of RADARSAT-2 is dependent on the optimal use of data by OGDs, the CSA must continue its efforts to facilitate the use of data and ensure that any barriers to use are minimized.*

While the CSA is not accountable for the use of RADARSAT-2 data, is it responsible for reporting on the benefits of the investment to the GoC.

> **Recommendation #8**: *The CSA must ensure that OGDs are fulfilling the annual reporting requirements for the use of data and that the data being provided is adequate to report on the benefits of RADARSAT-2 to the GoC.*

Overall, the RADARSAT-2 MCP was successfully managed and implemented, with the exception of a few issues related to security and the clarity and acceptance of roles and responsibilities. The CSA was also successful in providing data continuity with a system that is a technical advancement over RADARSAT-1. In determining the overall long-term benefits of RADARSAT-2, the CSA must put in place the proper performance monitoring system to measure for example the benefits of the project to the value-added sector and to assess whether the P3 model was a good investment for the GoC (i.e., maximum benefit for the cost) which is dependent on the use of data by OGDs.

As per TBS policy, the CSA has developed a management action plan in response to the recommendations included in the evaluation report (Appendix F).

Appendix A - Radarsat-2 Major Crown Project Evaluation Matrix

Questions	Indicators	Methodologies											
		Interviews								LL Exercise		Document Review	
		CSA					MDA	GSI	OGD	Int	FG Survey		
		Sen. Mag't	PMO	Sat Ops	EOAU	Other							
1.0 Relevance													
1.1 Was the RADARSAT-2 Major Crown Project (MCP) consistent with federal government policies and priorities and CSA mandate, mission, and objectives?	1.1.1 Degree of consistency of RADARSAT-2 MCP objectives and expected outcomes with federal government policies and priorities	■				■[50]			■			■	Treasury Board (TB) submissions, Speeches from the Throne, federal budgets, central agency decisions, policy statements, LLTSP-II, Program Profile, CSA Strategy (Earth Observation (EO) Strategic Plan)
	1.1.2 Degree of consistency of RADARSAT-2 MCP objectives and expected outcomes with CSA mandate, mission, objectives, and roles	■	■	■	■	■[51]						■	TB submissions, CSA reports on plans and priorities, CSA annual reports, CSA PAA, LLTSP-II, CSA Act, CSA mission and mandate, Program Profile, CSA Strategy (EO Strategic Plan)

[50] This will include representatives from other CSA Branches, such as Policy and External Relations.
[51] This will include representatives from other CSA Branches, such as Policy and External Relations.

Questions	Indicators	Methodologies											
		Interviews								LL Exercise		Document Review	
		CSA					MDA	GSI	OGD	Int	FG Survey		
		Sen. Mag't	PMO	Sat Ops	EOAU	Other							
2.0 Success and Impacts													
Project Implementation and Management													
2.1 To what extent did the RADARSAT-2 MCP fulfill the mandatory requirements for the management of a MCP?	2.1.1 A senior manager was appointed project leader and was accountable for the implementation of the project											■	Project Briefs
	2.1.2 A Senior Project Advisory Committee (SPAC) was established and functioned well: • Representation from all participating departments • Regular meetings held to discuss project status	■	■						■			■	TBS Policy on MCP, SPAC agendas, presentations, and membership
	2.1.3 Project scope was defined, kept up-to-date, and changes in scope were documented											■	Project Briefs, TB submissions
	2.1.4 Appropriate project management principles (e.g., internal policies, guidelines, and practices) were established and followed by all staff	■	■									■	Project Implementation Plan (PIP), Project Approval Document (PAD), Project Approval and Management Framework (PAMF), various progress reports

Questions	Indicators	Methodologies											
		Interviews								LL Exercise		Document Review	
		CSA					MDA	GSI	OGD	Int	FG Survey		
		Sen. Mag't	PMO	Sat Ops	EOAU	Other							
	2.1.5 Project profile, risk assessment and risk mitigation strategies were developed									■		■	Project Profile and Risk Assessment (PPRA), RADARSAT-2 Risk Database, Project Briefs, Lessons Learned Report
	2.1.6 A project performance measurement system was established											■	Reporting mechanisms (e.g., CSA and MDA weekly, quarterly and / or monthly reports)
2.2 Were sufficient financial and human resources allocated to the project given the scope, complexity, partnership arrangement, and risk of the project?	2.2.1 Financial resources allocated for this project											■	Project Briefs, TB submissions
	2.2.2 Level of human resources, and stability and continuity in key staff positions									■		■	Background data from Salary Management System, Project Briefs, PIP, Lessons Learned Report
	2.2.3 Whether or not sufficient resources were allocated to the project									■	■		Lessons Learned Report
2.3 How effective were the agreements between the CSA and other government departments (OGDs)?	2.3.1 Number of agreements in place or to be in place (i.e., discussion / negotiation has been initiated) between CSA and OGDs											■	MOU with Canada Centre for Remote Sensing (CCRS) and 2 supporting agreements with Department of National Defence (DND), and other agreements, as appropriate
	2.3.2 Effectiveness of CSA and OGD agreements	■	■	■	■	■[52]			■				

[52] This will include representatives from other CSA Branches, such as Systems Engineering.

Questions	Indicators	Methodologies											
		Interviews								LL Exercise		Document Review	
		CSA					MDA	GSI	OGD	Int	FG Survey		
		Sen. Mag't	PMO	Sat Ops	EOAU	Other							
2.4 To what extent did the Project Management Office (PMO) establish good working relationships with other CSA directorates?	2.4.1 Number of committees and working groups established											■	Operations Transition Working Group Documentation
	2.4.2 Nature and level of interaction between PMO and other CSA directorates		■	■	■	■[53]			■				
	2.4.3. Quality of the working relationships between the PMO and other CSA directorates		■	■	■	■[54]			■				
2.5 How effective was the project management plan, the project organization, tools, and management systems?	2.5.1 Variance between planned and actual schedule (including explanations for project delays)									■	■	■	MCP Close-out Report, PIP, Project Briefs, Lessons Learned Report, Quarterly Progress Reports
	2.5.2 Variance between planned budget and actual budget (including explanations for overruns)									■	■	■	Financial report, Project Briefs, Lessons Learned Report
	2.5.3 Extent to which performance data have been collected and used	■	■			■[55]				■		■	Reporting mechanisms (e.g., CSA and MDA weekly, quarterly, and / or monthly reports), Lessons Learned Report
	2.5.4 Extent to which reporting requirements were followed	■	■			■[56]			■			■	Reporting mechanisms (e.g., CSA and MDA weekly, quarterly, and / or monthly reports)

[53] This will include representatives from other CSA Branches, such as Finance, Communications, Policy and External Relations, and Systems Engineering.
[54] This will include representatives from other CSA Branches, such as Finance, Communications, Policy and External Relations, and Systems Engineering.
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[56] This will include representatives from other CSA Branches, such as Systems Engineering.

Questions	Indicators	Methodologies											
		Interviews								LL Exercise		Document Review	
		CSA					MDA	GSI	OGD	Int	FG Survey		
		Sen. Mag't	PMO	Sat Ops	EOAU	Other							
	2.5.5 Effectiveness of project implementation	■	■	■	■		■		■	■			Lessons Learned Report
2.6 How well did the public-private arrangement work?	2.6.1 Level of clarity of the Master Agreement (MA)	■	■	■	■		■			■			Lessons Learned Report
	2.6.2 Level of clarity of MDA's and CSA's common objectives									■		■	Project Briefs, MA (D-1), Lessons Learned Report
	2.6.3 Level of clarify of roles and responsibilities	■	■	■	■		■			■		■	MA, Lessons Learned Report
	2.6.4 Level of information access and programmatic oversight available to GoC									■		■	MA, Lessons Learned Report
	2.6.5 Number of committees / working groups established											■	MA, Senior Quarterly Review Presentation Materials
	2.6.6 Nature and level of interaction between MDA and CSA	■	■	■	■	■[57]	■			■	■	■	MDA Technical Reviews, MA, Lessons Learned Report
	2.6.7 Success of the public-private arrangement	■	■	■	■	■[58]	■		■	■	■		Lessons Learned Report
2.7 Has CSA successfully completed the close-out of the MCP?	2.7.1 Status of CSA Construction-to-Operations Transition Plan									■		■	MCP Close-out Report, RADARSAT-2 Construction-to-Operations Transition Plan, Lessons Learned Report
	2.7.2 PMO has been dismantled											■	MCP Close-out Report
	2.7.3 Contract close-out has been completed											■	MCP Close-out Report

[57] This will include representatives from other CSA Branches, such as Finance, Communications, Policy and External Relations, and Systems Engineering.
[58] This will include representatives from other CSA Branches, such as Policy and External Relations, and Systems Engineering.

Questions	Indicators	Methodologies											
		Interviews								LL Exercise		Document Review	
		CSA					MDA	GSI	OGD	Int	FG Survey		
		Sen. Mag't	PMO	Sat Ops	EOAU	Other							
	2.7.4 Financial close-out has been completed											■	MCP Close-out Report
	2.7.5 All project-related records have been collected and archived											■	MCP Close-out report
	2.7.6 All assets in defined in the MA have been transferred to MDA											■	Equipment Transfer Legal Documents
Project Impact													
2.8 To what extent did RADARSAT-2 contribute to the continuation of Canadian leadership in synthetic aperture radar (SAR) technology (e.g., use of state-of-the-art SAR technology, distribution of SAR data)?	2.8.1 Number of national space agencies involved in the civilian satellite SAR technology area											■	SAR Technology in Canada
	2.8.2 Ranking of RADARSAT-2 against other satellite SAR systems											■	SAR Technology in Canada
	2.8.3 Extent to which RADARSAT-2 met all technical requirements					■[59]				■		■	Technical Acceptance, Lessons Learned Report
	2.8.4 RADARSAT-2 contribution to the continuation of Canadian leadership in SAR technology					■[60]							
2.9 To what extent did RADARSAT-2 contribute to the development of EO business in Canada?	2.9.1 Level of participation of OGDs to RADARSAT-2											■	MOUs, User Readiness and Preparation Report
	2.9.2 Level of readiness of the value added industry to exploit the capabilities of RADARSAT-2				■			■				■	User Readiness and Preparation Report

[59] This will include RADARSAT-2 Constellation system engineers.
[60] This will include RADARSAT-2 Constellation system engineers.

Questions	Indicators	Methodologies											
		Interviews									LL Exercise	Document Review	
		CSA					MDA	GSI	OGD	Int	FG Survey		
		Sen. Mag't	PMO	Sat Ops	EOAU	Other							
	2.9.3 Number of university, private sector, and government researchers involved in the study of RADARSAT-2 relevant applications											■	User Readiness and Preparation Report, SOAR documents
	2.9.4 Number of proposals submitted to Earth Observation Applications Development Program (EOADP)											■	User Readiness and Preparation Report, EOADP documents
	2.9.5 Number of EOADP funded projects											■	User Readiness and Preparation Report, EOADP documents
	2.9.6 Number of industry applications developed				■			■					
	2.9.7 RADARSAT-2 contribution to the development of EO business in Canada		■		■	■[61]		■		■			Lessons Learned Report, MDA Business Plan Evolution Report

[61] This will include representatives from other CSA Branches, such as Policy and External Relations.

Questions	Indicators	Methodologies											
		Interviews								LL Exercise		Document Review	
		CSA					MDA	GSI	OGD	Int	FG Survey		
		Sen. Mag't	PMO	Sat Ops	EOAU	Other							
2.10 To what extent did RADARSAT-2 bring about industrial and regional benefits in Canada?	2.10.1 Percentage of direct Canadian content for the design, development, and manufacture of RADARSAT-2 space and ground segments											■	RADARSAT-2 MDA IRB Plan and Final Report, Project Briefs
	2.10.2 Percentage of Canadian content value in MDA's indirect IRB transaction sheets											■	RADARSAT-2 MDA IRB Plan and Final Report, Project Briefs
	2.10.3 Dollar value of contract to SMEs engaged in the project											■	RADARSAT-2 MDA IRB Final Report, Project Briefs
	2.10.4 Whether RADARSAT-2 brought about industrial and regional benefits in Canada					■[62]				■			Lessons Learned Report
2.11 To what extent did RADARSAT-2 meet its international objectives (e.g., NASA agreement)?	2.11.1 Whether RADARSAT-2 meet its international objectives									■			Lessons Learned Report
2.12 To what extent is CSA ready for the optimal use of data allocation by OGDs?	2.12.1 Level of participation of OGDs to RADARSAT-2											■	MOUs, User Readiness and Preparation Report
	2.12.2 Number of agreements in place with OGDs to obtain images from RADARSAT-2											■	MOUs, Government Data Management Plan

[62] This will include Policy and External Relations.

Questions	Indicators	Methodologies											
		Interviews								LL Exercise		Document Review	
		CSA					MDA	GSI	OGD	Int	FG Survey		
		Sen. Mag't	PMO	Sat Ops	EOAU	Other							
	2.12.3 Extent to which CSA is ready for the optimal use of data allocation by OGDs	■	■	■	■		■	■	■				
	2.12.4 Intended uses for RADARSAT-2 data by OGDs								■			■	MOUs, User Readiness and Preparation Report, RADARSAT-2 symposium, Government Data Management Plan
3.0 Other													
3.1 What best practices or lessons learned can be carried forward to future projects?	3.1.1 Best practices or lessons learned from RADARSAT-2											■	Lessons Learned Report
3.2 Did RADARSAT-2 MCP result in any value-added activities or expertise gained with the PMO?	3.2.1 Value activities or expertise gained in the PMO		■										

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Appendix C - List of Interviewees

Name of Interviewee	Current Position	Current Organization	R-2 MCP Role
Senior Management			
Savi Sachdev	Director General, Space Programs	Canadian Space Agency	R-2 Project Leader, CSA
Project Management Office			
Luc Brûlé	Director, Technology Management and Applications	Canadian Space Agency	R-2 Project Manager, CSA
Michel Gamache	Manager, Projects Portfolio, Earth Observation Projects	Canadian Space Agency	Deputy Project Manager, CSA
Catherine Casgrain	Senior Project Manager, Earth Observation Projects	Canadian Space Agency	Deputy Project Manager, CSA
Jill Smyth	Project Manager, Earth Observation Projects	Canadian Space Agency	Communication, Liaison with EOAU, Engineer Project Manager, CSA
Anthony Kittridge	Project Management Consultant	Lansdowne Technologies	Consultant, Lansdowne Technologies
François Gougeon	Director, Space Programs	Public Works and Government Services Canada	Contracts, PWGSC
Chris Lorenz	Director, Regional Projects	Public Safety Canada	Liaison with DND, CSA
Dean Sangiorgi	Technology Development Officer, Spacecraft Technologies	Canadian Space Agency	Finance, CSA
Other CSA Directorates			
Surendra Parashar	Director, Satellite Operations	Canadian Space Agency	R-1 Program Manager, R-2 Operations Transition, SatOps, CSA
Dan Showalter	Director, David Florida Laboratory	Canadian Space Agency	Manager, System Operations, Sat Ops, CSA
Denis Auger	Head, Earth Observation Applications and Utilizations	Canadian Space Agency	Program Manager, Earth Observation Application Development Program (EOADP), Commercialization Office
Daniel De Lisle	Liaison Officer	CSA Liaison Office	Manager, R-2 Applications and Utilization Also involved in data policy development and transition plan
Louise Aubin	Financial Manager, Space Programs	Canadian Space Agency	Finance, CSA
Jean-Marc Chouinard	Chief, Policy and Regulatory Affairs	Canadian Space Agency	Earth Observation Applications and Utilizations, CSA
André Vigneault	Head, Industrial Policy and Relations with Stakeholders, Policy and External Relations	Canadian Space Agency	Monitor MDA's performance against IRB commitments, CSA

Name of Interviewee	Current Position	Current Organization	R-2 MCP Role
Francis Foran	Manager, Systems Development, Systems Engineering	Canadian Space Agency	Engineering support to PMO, CSA
Mark Oksenhendler	Staff Systems Engineer, Systems Engineering	Canadian Space Agency	Engineering support to PMO, CSA
Marko Adamovic	Systems Engineer, Systems Engineering	Canadian Space Agency	Engineering support to PMO, CSA
Paul Engel	Director, Communications and Public Affairs	Canadian Space Agency	Communication activities (i.e., strategic communications, marketing, public affairs, and events), CSA
Jean-Pierre Arsenault	Manager, Corporate Communications, Communications and Public Affaires	Canadian Space Agency	Media relations and Web site, CSA
MDA / GSI			
Tony Hillman	R-2 Manager of Operations	MacDonald, Dettwiler and Associates Ltd.	Project Manager, Operations Development
Hans Baeggli	Project Manager	MacDonald, Dettwiler and Associates Ltd.	Deputy Project Manager
Philippe Rolland	Project Manager	MacDonald, Dettwiler and Associates Ltd.	Mission Operations Manager
John Horsnby	General Manager	Geo-spatial Systems Inc.	Involved in operational aspects of the project (e.g., requirements definition)
OGD Partners / Users			
Chuck Livingstone	Group Leader, Space-Based Radar	Defence Research and Development Canada	RADARSAT-2 user department, responsible for MODEX component
Tom Feehan	Manager, Earth Observation Data Services, Data Acquisition Division	Canada Centre for Remote Sensing	Responsible for the science data group segment development and management
Robert Maniquet	Senior IT Security Analyst, IT Security Client Establishment	Communication Security Establishment Canada	To ensure the right communication security (encryption), to protect Canada's assets
Lionel "JJ" Tremblay	Major Director, Space Development 6-3, Strategic Planning – National Relations	Department of National Defence	Involved in defence and security aspects, data distribution, and data policy
Thomas Gillon	Head, Remote Sensing Space Systems Section	Department of Foreign Affairs and International Trade	Senior Policy Officer, DND Responsible for security requirements, RSSS, data policy, and encryption, DFAIT
Mike Manore	Director, Network Strategy and Design	Environment Canada	RADARSAT-2 user department

Appendix D - RADARSAT-2 Major Crown Project Interview Guide

Question	Ind	Group											
		CSA								MDA	GSI	OGDs	
		Senior Mag't	PMO	SatOps	EOAU	Fin	Comm	PER	Eng			Partners	Users
Section 1.0 – Background													
1. Can you briefly describe your role in the RADARSAT-2 Major Crown Project (MCP)?	--	■	■	■	■	■	■	■	■	■	■	■	■
Section 2.0 - Project Relevance													
2. What were the key objectives of the RADARSAT-2 MCP?	1.1.1	■	■	■	■			■				■	■
a. How did these objectives align with the objectives federal government policies and priorities?	1.1.1	■						■					
b. How did these objectives align with the mandate and mission of your organization?	1.1.1											■	■
c. How did these objectives align with CSA mandate, mission, objectives, and role?	1.1.2	■	■	■	■			■					
Section 3.0 - Project Implementation and Management													
3. The CSA put in place a number of agreements with partners to support the RADARSAT-2 MCP (e.g., DND, CCRS). How effective were these agreements? For example, did the CSA obtain required services/products as expected?	2.3.2	■	■	■	■				■				
4. Your organization had an agreement in place for the RADARSAT-2 MCP. How effective was this agreement (e.g., clarity of roles and responsibilities, objectives)?	2.3.2											■	
5. A requirement of the MCP was the establishment of a Senior Project Advisory Committee (SPAC). How effective was this committee (e.g., forum for discussing issues, providing input into MCP)?	2.1.2	■	■									■	■

Question	Ind	Group											
		CSA								MDA	GSI	OGDs	
		Senior Mag't	PMO	SatOps	EOAU	Fin	Comm	PER	Eng			Partners	Users
6. Can you please explain what project management principles (e.g., internal policies, guidelines, and practices) were in place for the management of the RADARSAT-2 MCP? a. Were these principles appropriate, given the nature of the project? b. Were these project management principles were followed by all staff?	2.1.4	■	■										
7. What mechanisms were in place to allow for communications / exchange of information between the PMO and other CSA Directorates (e.g., SatOps, EOAU, Communications, and Finance) / your organization? For example, were there formal committees in place, working groups, regular meetings?	2.4.2		■	■	■	■	■	■	■			■	
8. Using the rating scale below, overall, how would you characterize the working relationship between the PMO and other CSA Directorates / your organization? Please explain your response. Poor Excellent 1 2 3 4 5	2.4.3		■	■	■	■	■	■	■			■	
9. Throughout the course of the project, did you have enough information available to you to fulfill your responsibilities for the MCP? For example, did you have enough information to make necessary decisions, to monitor the progress of the project, identify project issues? a. How did you receive this information (e.g., formal reports, via meetings)? b. Did all stakeholders comply with the reporting requirements? c. Was there additional information that would have been useful to you?	2.5.3 2.5.4	■	■						■			■	

Question	Ind	Group											
		CSA								MDA	GSI	OGDs	
		Senior Mag't	PMO	SatOps	EOAU	Fin	Comm	PER	Eng			Partners	Users
10. Can you please briefly describe the project management methodology that was in place to manage the RADARSAT-2 MCP?	2.5.5		■										
11. Using the rating scale below, overall, how would you characterize the effectiveness of project implementation by CSA? Please explain your response. Not at all effective Very effective 1 2 3 4 5	2.5.5	■	■	■	■					■		■	
12. The Master Agreement between the CSA and MDA was the key document used to guide the MCP. How clear was the Master Agreement in outlining: a. The objectives of the MCP? b. The roles and responsibilities of both CSA and MDA?	2.6.1 2.6.3	■	■	■	■					■			
13. What mechanisms were in place to allow the communications / exchange of information between the CSA and MDA. For example, were there formal committees in place, working groups, regular meetings? a. How effective were these mechanisms?	2.6.6	■	■	■	■	■	■	■	■	■			
14. Using the rating scale below, overall, how would you characterize the success of the public-private arrangement? Please explain your response. Not at all successful Very successful 1 2 3 4 5	2.6.7	■	■	■	■			■	■	■		■	
15. As a result of the RADARSAT-2 MCP, did the PMO gain any expertise or particular value-added skills?	3.2.1		■										

Question	Ind	Group											
		CSA								MDA	GSI	OGDs	
		Senior Mag't	PMO	SatOps	EOAU	Fin	Comm	PER	Eng			Partners	Users
Section 4.0 - Project Impact													
16. Did RADARSAT-2 meet all technical requirements, as per the required specifications?	2.8.3								■				
17. One of the objectives of the RADARSAT-2 MCP was to contribute to the continuation of Canadian leadership in SAR technology. Using the rating scale below, please indicate the extent to which the MCP achieved that goal. Please explain your response. No extent Great extent 1 2 3 4 5	2.8.4								■				
18. Are the value-added industries currently in a position to exploit the capabilities of RADARSAT-2? Why or why not?	2.9.2				■						■		
19. How many new industry applications have been developed as a direct result of the RADARSAT-2 MCP?	2.9.6				■						■		
20. One of the objectives of the RADARSAT-2 MCP was to contribute to the Earth Observation business in Canada. Using the rating scale below, please indicate the extent to which the MCP achieved that goal. Please explain your response. No extent Great extent 1 2 3 4 5	2.9.7		■		■			■			■		

Question	Ind	Group											
		CSA								MDA	GSI	OGDs	
		Senior Mag't	PMO	SatOps	EOAU	Fin	Comm	PER	Eng			Partners	Users
21. One of the objectives of the RADARSAT-2 MCP was to bring industrial and regional benefits in Canada. Using the rating scale below, please indicate the extent to which the MCP achieved that goal. Please explain your response. No extent Great extent 1 2 3 4 5	2.10.4							■					
22. Is the CSA currently in a position to ensure that RADARSAT-2 data will be optimally used by other government departments? Why or why not?	2.12.3	■	■	■	■					■	■		
23. Is your department currently in a position to receive and use RADARSAT-2 data? Why or why not? a. What are your department's intended uses for the RADARSAT-2 data?	2.12.3 2.12.4											■	■
25. Is there anything else you would like to add?	---	■	■	■	■					■	■	■	■

Appendix E - Summary of Lessons Learned

This table has been adapted from the summary table of lessons learned presented in the *CSA RADARSAT-2 Project Lessons Learned Exercise*, December 2008 (pages iv-x).

#	Topic	Event	Lesson Identified
1.	Master Agreement Objectives	There were misunderstandings during the life of the Project as a direct result of differing views of the priorities and the absence of a clear articulation of what were the common objectives.	Within the overarching aim of the Project, there were no common objectives defined in writing. While the MA contains considerable details, there is little on how to resolve pressures on cost, scope, and schedule. This led to misunderstanding and conflict when the Parties saw trade-offs from entirely differing perspectives.
2.	Project Management Office Stability	Senior management within the CSA assigned a high priority to the RADARSAT-2 MCP, and this led to a concerted effort to maintain stability in the PMO.	The RADARSAT-2 MCP benefited from exceptional stability and continuity among the key players. The benefits were greater efficiencies, enhanced CSA corporate knowledge, and the opportunity for continuity of effort and stronger working relationships.
3.	Access to Project Information	Several sections of the CSA and OGDs observed that there was insufficient access to all of the requisite project and procurement documentation. This was an issue of access not communications.	The solicitation documents did not provide sufficient guarantees of access to project information and overall oversight for Canada. This should have been done considering the significant financial contribution being made. This led to challenges for the CSA and occasionally necessitated the development of recommendations without benefit of all of the information held by MDA.
4.	Stakeholder Communications	Many complicated and sensitive issues spanning several years were addressed satisfactorily as a direct result of the professionalism and effective communications between CSA and MDA.	Notwithstanding the extraordinary challenges within the Project, relating to technical, programmatic, and financial issues, the strong level of communications and professionalism established between the CSA and MDA were contributors to the Project's success.
5.	Commercialization of Earth Observation	Projections for the commercialization of EO have proven to be most optimistic. The combined efforts of both MDA and the GoC to market RADARSAT-2 have been hindered by the risk of technological development and Project delays.	Market research and commercial projections resulting from advanced technological development need to consider all of the factors including the risks posed by schedule delays, changing user requirements, and competitive pressures. When the GoC commits to support a Canadian commercial entity in marketing a capability, a clear strategy involving all departments and agencies is needed.
6.	Communications and Project Profile	Promotion of the RADARSAT-2 satellite launch and the overall Project did not result in significant awareness of the Canadian public.	The relatively low profile enjoyed by the CSA with the Canadian public and political leadership needs to be addressed to sustain future space-based projects.
7.	Senior Management Support and Involvement	The RADARSAT-2 project benefited directly from the active engagement of senior management.	The success of any MCP is proportional to the direct engagement and support of the Project Leader (PL) and senior management.

#	Topic	Event	Lesson Identified
8.	Project Security Officer	Security issues were not addressed adequately at the outset of the Project and many issues arose that were unforeseen. Frequently, resolution of issues required a more costly solution and a disproportionate level of effort from the CSA PMO, OGDs, and MDA.	A Project Security Officer needs to be designated for all major projects with a significant security component. This need not be a dedicated or full-time resource. To be successful security planning issues must be addressed at the earliest stages.
9.	Use of Government Technical Expertise	MDA lacked technical and engineering maturity and expertise in certain areas. They did not exploit fully the offers of assistance from the CSA staff and this contributed to schedule delay and frustration.	An opportunity was lost, notwithstanding the limited technical role assigned to the CSA, to exploit the knowledge, expertise, and experience of the technical staff. An effective consultative arrangement could have been created and led to earlier resolution of some technical issues.
10.	Risk Management	Stakeholders within the CSA observed on the effectiveness of the risk management processes as applied to the RADARSAT-2 MCP.	Effective risk management processes are in place in the CSA and these processes need to continue to be fostered and supported for all projects.
11.	Operations Transfer - MDA and Space Operations	All parties noted that considerable time and effort by both MDA and CSA were devoted to resolving operations transition issues. This proved to be a difficult and often frustrating process for those involved.	The handling of operations transition issues between SatOps and MDA could have been managed more effectively. The time dedicated to this issue was excessive and led to confusion as some of the principles negotiated within the MA were resisted.
12.	Project Management Functions – P3	CSA staff observed that occasionally they were engaged in discussions with MDA that they did not feel comfortable with. They observed that they did not always have a clear understanding of what they were permitted to commit to on behalf of the CSA and the Crown.	When employing a P3 in a project, CSA senior management should consider the need for additional training and familiarization for staff that will be engaged in informal negotiations on technical, financial, and programmatic issues. All staff must receive the appropriate levels of authority to deal with issues with the private partner.
13.	Project Performance Management System (PPMS)	TBS Guidelines stipulate that the Project Manager (PM) implement a PPMS appropriate to the size and complexity of the project. As a result of the fixed price contract and the leading role of the Prime Contractor, this was not employed.	The value of employing a PPMS that includes Earned Value Management (EVM) was not achieved on the RADARSAT-2 MCP. There was no evidence of the employment of earned value techniques by CSA and MDA.
14.	Senior Management Support and Phase E Activities	Senior management support was evident in the RADARSAT-2 MCP during Phase A and throughout Phases B through D. There was a perceived decrease in the degree of such support as the Project approached the transition from Phase D to E.	Senior management support needs to be sustained throughout the life cycle of a MCP including the operation phase.

#	Topic	Event	Lesson Identified
15	Project Management Office Structure – P3	The RADARSAT-2 MCP faced some unique issues and several arose late in the approach to the satellite launch and when the launch site was changed. This resulted in significant security and legal issues, which required the immediate mobilization of additional project resources.	The RADARSAT-2 MCP was staffed to a modest level and occasionally was challenged to manage all issues including those that are unforeseen. Expertise in highly specialized areas needs to be available on a priority basis proportionate to the GoC investment and exposure.
16	Project Phases and Transfer Procedures	Like all projects in the CSA, the RADARSAT-2 MCP went through a transition between phases, including between Phase D and E. This can lead to higher risk should transfers occur with inadequate preparation.	The transferring of responsibility for a project from one organization presents unique risks. A well developed Transition Plan is critical to reducing this risk.
17	Security - Launch Campaign	The development, approval, and execution of the RADARSAT-2 Transportation and Launch Security Plan identified several challenges associated with security planning and awareness in the Agency and with OGDs.	In the RADARSAT-2 MCP several security issues were only identified when they became essential or urgent. Security planning and awareness need to receive a higher priority in the CSA.
18	International Traffic in Arms Regulations (ITAR) and Controlled Goods Regulations	Several staff in the CSA cited the growing challenges posed by the need to respect licensing requirements imposed under the ITAR. For the RADARSAT-2 MCP this impacted Project costs and schedule.	The current security environment and the increasing need to protect national security interests demands a better understanding of the regulations and restrictions being imposed under ITAR and other export control mechanisms within the CSA.

Appendix F - CSA Management Response to Recommendations

Ref.	Recommendations	Responsibility Identified		Details of Action Plan	Timetable
		Organization	Function		
PROJECT IMPLEMENTATION AND MANAGEMENT					
1)	The CSA must ensure that issues such as security are given much more of a priority and are addressed at the outset of the project.	Space Programs has the lead with strong support from Policy and Regulatory Affairs (PER), Security and Facilities, and IM / IT	The Director responsible for the Project and, through him, the PM. PER, Chef, Policy and Regulatory Affairs Departmental Security Officer IT Security Coordinator	Learning from RADARSAT-2, new projects like RADARSAT Constellation Mission (RCM) and Polar Communication Weather (PCW) mission are already addressing the security issues at the outset of the project. Early on, a Threat and Risk Assessment are made in collaboration with DND. Security plans are being prepared at the beginning of Phase B (RCM) and interdepartmental meetings with DFAIT, DND, CSEC are taking place in Phase A (PCW) to establish security requirements. Within the PER group, a position of Chief, Policy and Regulatory Affairs has been created and acts as the POC for security issues with OGDs for PCW. PADs have now a section on security requirements.	Completed
2)	For future projects, the CSA should model the success of the PMO during the RADARSAT-2 MCP in ensuring openness and transparency and establishing good communications both with partners and internal CSA Directorates.	CSA	DGs, Directors, PMs	Lessons learned from previous projects should be reviewed by project teams as part of their planning process as indicated in the PAD preparation instructions (item 12). For RADARSAT-2, the lessons learned were communicated through a well attended event in December 08. This should be done for all projects. "Soft skills" should be given more importance in PM job assignments and job hiring. This is already reflected in the ENG competitions presently taking place. Regarding communication with industrial partners: Statements of Work already includes a provision for regular and ad hoc meetings contributing to the culture of openness and transparency.	Ongoing Ongoing Completed

Ref.	Recommendations	Responsibility Identified		Details of Action Plan	Timetable
		Organization	Function		
3)	For future projects, the CSA must ensure that the common objectives between itself and industrial partners as well as the roles and responsibilities of all of the partners, are clearly articulated in project documentation.	Space Programs in conjunction with sponsoring organization (Space Science or Space Tech)	Project Managers in conjunction with Mission Managers	The nature of the RADARSAT-2 MCP, whereby MDA was a contributing partner, implied that there were gray zones or zones where each partner had to defend its interest which was not always the same as for the other partners. For future projects involving partners, despite good relationship between the partners, efforts will be invested to assure that agreements reflect common objectives and that they are clearly articulated in documentation as well as their roles and responsibilities.	Ongoing
4)	The CSA should conduct a cost-effectiveness analysis to determine whether the savings generated by using the P3 model resulted in similar benefits to the GoC than those resulting from RADARSAT-1.	Audit and Evaluation		The opportunity to make a cost-efficiency analysis will be assessed during the development of the departmental five-year evaluation plan.	April 2010
5)	For future projects, the CSA must ensure that the CSA's role is clearly defined at the beginning and that all CSA representatives are comfortable with that role and accept their responsibilities in fulfilling that role.	Core functions Directions	DGs, Directors	RADARSAT-2 started in 1998. The CSA was young and procedures and processes were not yet in place. Today, the roles and responsibilities of each team member is clearly defined in PADs and PIPs and agreed with the Directors and DGs. Also, a Transition Plan from Phase D to E was elaborated and signed by the three core function Branches to assure a smooth transition and assure a common understanding of roles and responsibilities.	Completed

Ref.	Recommendations	Responsibility Identified		Details of Action Plan	Timetable
		Organization	Function		
PROJECT IMPACT					
6)	Because the benefit to the value-added sector was a critical factor in the success of RADARSAT-2, the CSA needs to establish appropriate measures to determine the impact of RADARSAT-2 on the value-added sector.	Space Tech	RADARSAT-2 RMAF	In future projects, the CSA should assure that objectives are feasible for the industry and proper mechanisms are in place for the CSA to ensure that they can be attained by industry. The RADARSAT-2 RMAF will include value-added performance indicators that could be monitored during the life time of the mission.	Ongoing
7)	Because the long-term success of RADARSAT-2 is depending on the optimal use of data by OGDs, the CSA must continue its efforts to facilitate the use of data and ensure that any barriers to use are minimized.	Space Tech Operations	EOAU SatOps	The CSA has already recognized the importance of the optimal use of RADARSAT-2 data by OGDs to the long-term success of RADARSAT-2. The work being done by EOAU and SatOps is already addressing this issue through: • GRIP which fosters the development of new applications by departments; • MOU with each user department to define their needs and responsibilities in the utilization of RADARSAT-2 data; • Management and monitoring of data usage by departments; • Working to reduce the incidence of conflicts and acting as an intermediary with MDA / GSI to resolve problems; • Annual Workshops with GoC users and others from industrial and international communities. The effort invested to maximize the use of RADARSAT-2 by the GoC users is serving as a model for RCM to pursue developing the GoC user community through the creation of a User and Science Team. The same applies to PCW whereby, as early as in Phase 0, a User and Science Team has been created to engage the GoC user community to support the development and use of PCW.	Ongoing Ongoing Ongoing Ongoing Ongoing Ongoing

Ref.	Recommendations	Responsibility Identified		Details of Action Plan	Timetable
		Organization	Function		
8)	The CSA must ensure that OGDs are fulfilling the annual reporting requirements for the use of data and that the data being provided is adequate to report on the benefits of RADARSAT-2 to the GoC.	Space Tech	EOAU	One of the requirements in the MOUs with the government departments is for departments to provide annual reports summarizing how data acquired was used and the related benefits over the previous year. Use will be further broken down by application maturity level and sector of application. The reports will highlight particular case studies and success stories, including cost-efficiency analysis as applicable, such that departments can draw links from the use of RADARSAT-2 data to their departmental mandate and strategic priorities as articulated in their mandates. Also, regular RADARSAT-2 workshops are being organized (held in September 2007, September 2008, and planned for Spring 2010) whereby GoC users will present their work accomplished with the RADARSAT-2 data and their plan for the future. This contributes to expand RADARSAT-2 application awareness and foster more utilization.	Ongoing Annually