Government Consulting Services

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Evaluation of the STDP

For the Period of 2002/03 to 2007/08

Prepared for: Canadian Space Agency

Project Number: 570-2800
Program Evaluation and Performance Measurement Team
June 2011

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

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Executive Summary

This report presents the findings of the summative evaluation of the Space Technology Development Program (STDP) for the period of fiscal year 2002/03 to fiscal year 2007/08. The evaluation was undertaken to respond to a 2005 CSA internal audit that recommended that a review of STDP service delivery be undertaken. The Canadian Space Agency (CSA) engaged Government Consulting Services (GCS) to undertake the evaluation.

The primary objective of the STDP is to develop and demonstrate strategic technologies and mission concepts that have a strong potential for having a positive impact on meeting the future needs of the Canadian Space Program and the growth of the Canadian space industry. The STDP accomplishes its R&D objectives by issuing contracts to Canadian companies, academic entities and not-for-profit organizations for the development of space technologies and mission concepts in areas of priority to the CSA and in areas where Canadian companies require support to develop or maintain new or existing R&D capabilities in areas of priority to the CSA.

Methodology

The STDP evaluation adopted various 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;
- stakeholder interviews;
- database review; and
- success stories.

The evaluation focused on four main areas: program relevance, program design and delivery, program success, and cost-effectiveness/alternatives.

Project Relevance

The STDP continues to be relevant as evidenced by its alignment with Government of Canada priorities, the objectives of the Canadian Space Strategy and the mandate of the CSA. While the STDP has met its own objectives, its focus has predominantly been, during the evaluation period, on assisting the Canadian space industry. In fact, there was universal agreement that the program has supported the industry. However, given that this is a contract-out program, the STDP needs to prioritize and focus on the objective of reducing risks associated with space missions, especially as it does not have the internal capacity to undertake all necessary space technology R&D.

> **RECOMMENDATION**:
>
> Greater clarity regarding the objectives of this contracting program is needed.

Program Design and Delivery

One of the key program design and delivery issues, identified in an internal CSA audit, was that STDP service contracts had some of the characteristics of financial assistance to third parties rather than true procurements of goods and services. The use of the STDP as a Gs&Cs program, rather than a contracting-out program, was not intentional. Rather, STDP had received limited information, internal to the CSA, regarding space technology R&D needed for future Canadian space missions. Consequently, the STDP relied mainly on input from the Canadian space industry for the identification of future space technology priorities. The STDP understood that focusing on funding 'industry identified' technologies would be beneficial to the Canadian space industry, thus contributing to their secondary goal of strengthening the industry.

To ensure that STDP is focused on funding space technology R&D that reduces risks associated with CSA missions, the program will need to be supplied with a current and relevant Technology Plan. In FY 2009/10 the Space Technology Branch actively began the development of a technology plan. To ensure that this plan provides more guidance to the STDP than previous versions that did not provide sufficient level of information, it will need to clearly identify: future missions, the technology required for those missions, the prioritization of the technologies for each mission, the time required to complete the R&D, the level of TRL for each technology, cost analysis, technology requestor, etc.

> **RECOMMENDATION**: CSA needs to clearly map all proposed missions and related R&D technology requirements.

Industry interviewees were satisfied with various aspects of the STDP contracting process, including: the overall clarity of the reporting requirements to CSA, the fairness of the selection process, and access to STDP contracts. However, over one-half (52.6%) of industry interviewees indicated that they were not satisfied with the efficiency of the RFP process. Respondents noted the inconsistency in the issuance of the RFP and the delay between the submission of proposals to the awarding of contracts (i.e., months). RFP and contract issuance delays are costly to both CSA and to industry, as time sensitive R&D is being delayed which negatively impacts the ability of the STDP to achieve its objectives. While STDP and PWGSC are attempting to facilitate the contracting process, delays are occurring from a lack of a shared understanding of the process requirements of each party.

> **RECOMMENDATION**: STDP personnel and PWGSC need to clearly map the procurement and contracting process, roles of each party, service standards, and their requirements

Some of the smaller space industry companies had noted that they would not bid for STDP contracts given the overall cost for them to participate versus the overall contract size. To ensure greater participation by industry, the STDP should consider whether a two-step application process is viable. Companies can put forward a letter of interest, and if STDP considers the R&D to be of value, than the company can be asked to submit a formal detailed proposal. Review of other R&D programs that conduct a two-step application process should be examined.

> **RECOMMENDATION**: Further study on the possibility of introducing a two-step application process: 1) letter of interest detailing the technology and 2) complete proposal if requested

The infrequency of RFP issuance may present challenges to smaller companies less familiar with the process of responding to contracts. While STDP personnel have provided assistance to companies bidding on contracts, more formalized documents may be required. There is significant amount of Government processing requirements that need to be met and a company not familiar with this process may be disqualified as a result of their lack of familiarity. It is recommended that various tools be developed that may be of assistance to companies less familiar to the STDP.

> **RECOMMENDATION**: CSA needs to improve communications with industry and stakeholders through announcements or workshops, ahead of the release of its RFPs.

Given that the RFPs predominantly reflected the space technology priorities of the Canadian space industry, and that there was no internal CSA requestor for that technology, when project reports were submitted to the program they were not forwarded within the Agency. Final project reports remained with the STDP. Consequently, much of the knowledge generated through the STDP was not transferred within the Agency. The Technology Plan currently being developed by the Space Technology Branch does require that a technology requestor be identified. This information should facilitate the STDP transferring knowledge generated from the program throughout the CSA.

> **RECOMMENDATION**: A formal communication strategy for communication of project results to interested CSA parties

Program Success

The STDP has had a strong impact on the Canadian space industry. The majority of companies interviewed acknowledged the importance of the program to the space industry and to their own companies. All interviewees have acknowledged that the funding has assisted in the advancement of their space technology R&D. The success stories strongly emphasize the impact that the contracts have had, in terms of employment, revenues, business opportunities (both national and international), commercialization of their products, and other spin-offs. It is evident that the STDP contracts have contributed to growth in the space industry.

Although various contracts were issued solely for the purpose of strengthening the Canadian space industry, the technologies developed from these contracts have contributed to advancing the Canadian Space Program by reducing risks associated with future missions, and or enabling potential new missions. The success stories also highlight that technologies have been used by other international space agencies. The Canadian Space Program is a tightly knit ecosystem which comprises government, industry and universities. An STDP investment in industry-driven

technologies has positive, direct and indirect impacts on the fabric of the whole Canadian Space Program; as STDP funded technologies exist not only to respond to CSA's programs but also to the much wider international commercial or government-to-government markets.

Cost-effectiveness/Alternatives

The evaluation team was unable to establish the cost-effectiveness of the STDP and to compare it with similar delivery models. Given the scope and nature of the STDP's mandate, the consulting team was unable to collect information on comparable programs in other space agencies or organizations. Furthermore, as this is solely a federal jurisdiction, there are no provincial or territorial models with which it could be compared. The uniqueness of the space industry also made it difficult to compare this program to programs in other industries. This uniqueness ensures that the program does not duplicate or overlap with other federal or provincial programs.

Commencing a comparison of the cost effectiveness of undertaking internal vs. external R&D was not considered as internal R&D at 100% is not an option for the Agency, or for any major space agency.

The program is cost-effective from an R&D perspective. Fundamentally, depending on industry investment requirements identified in STDP contracts, both the CSA and industry are benefitting by collaborating on space technology R&D. The total budget for R&D is augmented. Various companies had noted that they were able to undertake more R&D as their internal budget was augmented after obtaining a STDP contract.

1. Introduction

Government Consulting Services was engaged by the Canadian Space Agency (CSA) to undertake a summative evaluation of the Space Technology Development Program (STDP) for the period of fiscal year 2002/03 to fiscal year 2007/08. Since inception, the STDP has never been the subject of a formal evaluation and a 2005 internal audit recommended that a review of STDP service delivery be undertaken. An evaluation plan was developed for the STDP in March 2009, and it was this plan, which identified evaluation questions, issues, performance indicators, data sources and recommended data collection methodologies, that was followed for the summative evaluation. The intended audience of this evaluation is the Director General, Space Science & Technologies Branch of the CSA.

The purpose of a summative evaluation is to assess the degree to which desired outcomes have been achieved; and, the extent to which the program has contributed to the achievement of outcomes. Summative evaluations perform an accountability function, as well as being future oriented, providing recommendations on program design issues.

This evaluation study was conducted between July 2009 and January 2010. The findings from this evaluation, presented in this report, are organized into the following sections: the first provides a description of the approach and data collection methodologies used for this evaluation, the second presents a profile of this program, the third details the findings from the evaluation, and the last section presents recommendations.

2. Approach and Methodology

2.1 TBS policies, standards and directives

The STDP Evaluation Plan, completed in March 2009, followed the 2001 TBS Evaluation Policy where three primary issue areas for evaluation were considered:

- **Relevance** - Does the policy, program or initiative continue to be consistent with departmental and government-wide priorities, and does it realistically address an actual need?
- **Success** - Is the policy, program or initiative effective in meeting its intended outcomes, within budget and without unwanted negative outcomes? Is the policy, program or initiative making progress toward the achievement of the final outcomes?
- **Cost-Effectiveness** - Are the most appropriate and efficient means being used to achieve outcomes, relative to alternative design and delivery approaches?

The evaluation planning study, developed for this evaluation by Government Consulting Services (GCS) in March 2009, identified a series of evaluation questions that contribute to addressing the evaluation areas of relevance, success, cost-effectiveness/alternatives and design and delivery. They are:

Relevance

1. Does the program area/activity continue to serve the public interest?

Design and Delivery

2. Does the STDP's design and delivery allow the program to effectively achieve the program's objectives?

Cost-Effectiveness

3. Are there more cost-effective ways to achieve the same outcomes as the Program? / Is it more cost-effective for the CSA to conduct the research internally or have someone undertake it externally?
4. How could the efficiency of the STDP program be improved?

Program Success

5. How has the STDP positively contributed to the development of the economic viability of the Canadian space industry?
6. How has the STDP contributed to reducing the risks involved with CSA missions (failures, time, resources) and/or made new missions possible?
7. To what extent has the Canadian space industry increased its capacity over the years thanks to the technology development contracts granted by the STDP?
8. To what extent has the CSA increased its capacity over the years thanks to the technology required for the development and planning of new or current space missions thanks to the STDP?
9. Has the STDP generated any unintended impacts, results or benefits?

The STDP evaluation questions, and the corresponding performance indicators, measures and data sources are presented in Appendix A.

It should be noted that since the completion of the STDP Evaluation Plan, a new TBS Evaluation Policy took into effect on April 1, 2009. Again, the objective of the new policy is to create a comprehensive and reliable base of evaluation evidence that is used to support policy and program improvement, expenditure management, Cabinet decision making, and public reporting. Under the new policy, five core issues need to be addressed, although departments have the flexibility to determine the evaluation approach and level of evaluation effort in accordance with the program's risks and characteristics, and the quality of performance information available. Core issues include:

Issue #1: Continued Need for program	Assessment of the extent to which the program continues to address a demonstrable need and is responsive to the needs of Canadians
Issue #2: Alignment with Government Priorities	Assessment of the linkages between program objectives and (i) federal government priorities and (ii) departmental strategic outcomes
Issue #3: Alignment with Federal Roles and Responsibilities	Assessment of the role and responsibilities for the federal government in delivering the program
Issue #4: Achievement of Expected Outcomes	Assessment of progress toward expected outcomes (incl. immediate, intermediate and ultimate outcomes) with reference to performance targets and program reach, program design, including the linkage and contribution of outputs to outcomes
Issue #5: Demonstration of Efficiency and Economy	Assessment of resource utilization in relation to the production of outputs and progress toward expected outcomes

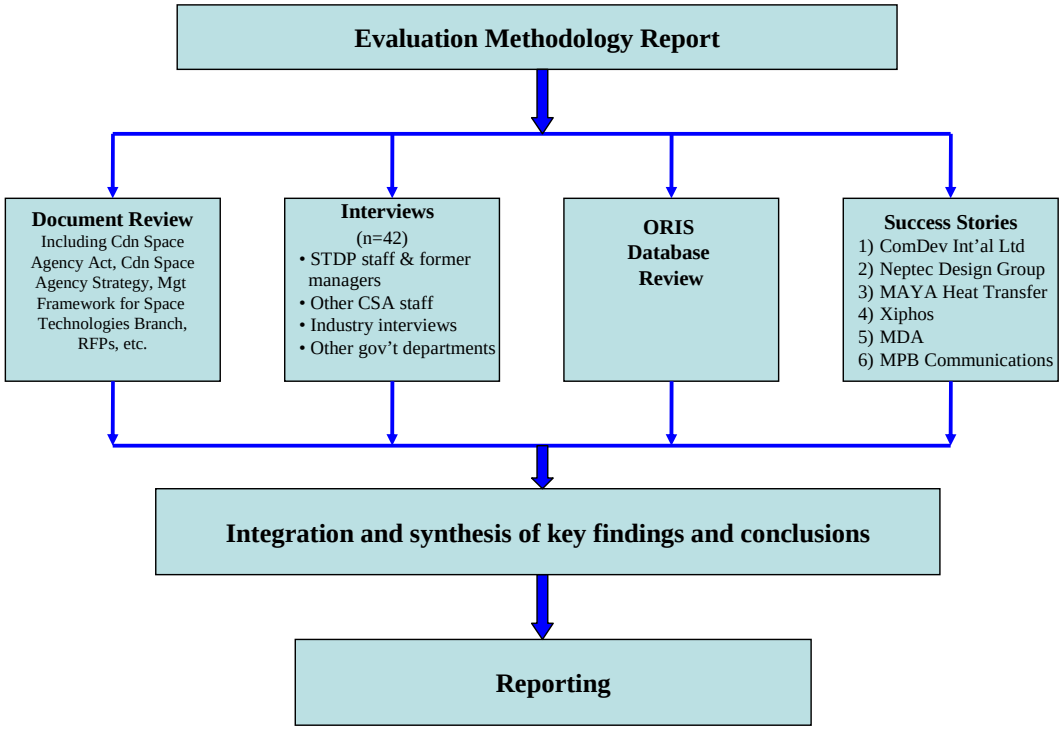
While the STDP Evaluation Plan was developed using the 2001 TBS Evaluation Policy, it also covers issues identified under the new policy.

In order to address the STDP evaluation questions, various lines of enquiry were employed, including document review, interviews, database review, and success stories.

2.2 Collection Methodology

As illustrated in Figure 1, various lines of enquiry were adopted to address the study objectives. These lines of enquiry parallel those that were outlined in the STDP Evaluation Methodology Report.

Figure 1 – Approach to data collection, analysis and reporting



Information was gleaned from multiple sources to enable the evaluation issues to be assessed from several perspectives and to better understand the positions advanced by participants who are most closely involved with the STDP. The approach to this evaluation involved:

Document Review

Review of relevant documents was undertaken. Documents included: various official policy documents (e.g., Treasury Board Submissions; Canadian Space Agency Act), the Canadian Space Agency Strategy, Management Framework for Space Technologies Branch, project selection criteria, Technology Development Group Year End Report, Federal S&T Strategy: Mobilizing Science and Technology to Canada's Advantage, etc. As part of the document review, an alignment exercise was undertaken. The alignment exercise was used to assess program relevance, and to ensure that there was consistency with the objectives of the STDP as outlined in the TB Submission to the Space Agency Act and government-wide priorities. The list of documents reviewed is located in Appendix B.

Interviews

As described in the STDP Evaluation Methodology Report interviews were conducted with a wide variety of stakeholders including STDP staff and former STDP managers, other CSA staff including senior management, industry interviews and representatives from relevant government departments. The total number of interviews conducted is as follows:

- STDP staff—included past and current members of STDP's management and program delivery team. (n=6)

- Other CSA staff—included individuals (outside of the STDP program) who were able to provide an assessment on the role and impact of the STDP within the CSA. (n=15)
- Industry Interviews—included companies from the Canadian space industry which have been awarded contracts through the STDP during the 2002-2007 evaluation period (n=19). Companies that had received contracts through the STDP were identified – a total of 73 companies. A representative sample of these companies, based on STDP amounts awarded, was selected. The consulting team ensured that industry representatives included companies that had received small to large sized contracts during the evaluation period. Discussions with CSA employees confirmed that all, but a handful of companies, have received STDP contracts. Therefore, the client base of STDP contracts is a mirror of the population of companies involved in the development of space technologies in Canada. [1]
- Other government departments—included individuals familiar with the design and delivery of the program (e.g., PWGSC and Industry Canada). (n=3)

Additional interviews were undertaken with industry and CSA in the creation of the success stories (n=10). The corresponding interview guides are located in Appendix C.

Success Stories

The focus of the success stories was to fully detail how STDP contracts led to the attainment of STDP intermediate and ultimate outcomes. In terms of the objectives of the STDP, as outlined in the Evaluation Plan, the program is trying to achieve the following two intermediate outcomes: 1) Reduced Risks Associated with CSA Missions and 2) Economic Viability of the Canadian space industry and the ultimate outcome of 'Socioeconomic Benefits for Canadians.

Although a few STDP R&D contracts may not have resulted in the advancement of the technology readiness level (TRL), and thus not directly contributing to the objectives of the STDP, the project failure is indicative of the experimental nature of R&D and the level of technical challenges. In fact, while there may not be advancement from a specific TRL to the next one, there may be advancement within the same TRL. The program funds projects at various levels of technology maturity— from conceptual to flight readiness. While R&D failure can be viewed as a success, as there is an increase in knowledge, the focus of the success stories was to highlight specific contracts or technologies that have had a significant impact for the Agency, for the companies, and ultimately to Canadians. The methodology is similar to that used in partial benefit-cost analysis (in which only projects obtaining high or very high impacts are studied), except that a full analysis of costs was not conducted. The greatest impacts typically result from a small or very small proportion of companies assisted through government R&D programs. Therefore, concentrating on the “high impact” projects is far more cost-effective than attempting to identify impacts for all client firms. However, it is important to note that with this technique it is not possible to extrapolate the case study findings to all STDP recipients, since the sample selection is not random. Therefore, STDP contract results (i.e., sales, FTEs) described in company ‘success stories’ are not necessarily reflective of all awarded STDP contracts.

[1] Canadian Space Agency, State of the Canadian Space Sector 2008, According to the State of the Canadian Space Sector 2008, there are approximately 200 organizations involved in space activities across Canada. The sector includes various categories, including space segment, ground segment, applications and services, and space research. Approximately, 40% of these companies are involved in the development of space technologies.

The consulting team based the selection of success stories on the feedback that was obtained from interviews with industry recipients of STPD contracts and CSA interviews. STDP funded technology that met one or more of the program outcomes were selected (i.e., technology was used on a space mission, or a STDP technology that now represents 80% of company revenues). Companies also agreed to have a case study written up. A total of six success stories were selected.

1. ComDev International Ltd.
2. Neptec Design Group
3. MAYA Heat Transfer Technologies Ltd.
4. Xiphos
5. MDA
6. MPB Communications

The success stories on the evolution of a technology (funded through one or a series of STDP contracts) or a series of technologies funded through the STDP that have benefited both the company, the Canadian space industry and/or the CSA. The complete success stories are presented in Appendix E.

The table below provides a breakdown of industry interviews conducted and success stories completed in comparison to the population of companies (n=73) that received STDP funding over the evaluation period (FY 2002/03 to FY 2007/08). The six companies written up as success stories represent 8% of the total number of companies that received funding over the evaluation period, and 39% of the total STDP funding allocated during that timeframe. Likewise, the interviews with industry companies represent one-quarter (26%) of the total number of companies that received funding and one-half (48%) of the total STDP funding allocated during this time period.

	Companies	**% of STDP funded companies (FY02/03-FY07/08)**	**% of total STDP funding (FY02/03-FY07/08)**
Success Stories	6	8%	39%
Industry Interviews	19	26%	48%
Number of companies covered	**19**	**26%**	**48%**
Total number of companies that received STDP funding	73	NA	NA

Database review/ORIS database

The STDP did maintain a database of contracts issued (ORIS database). Basic information on project title, contract value, start/end date were available, however, information on initial vs. actual TRL and jobs created were incomplete. A review of the data available was undertaken, but analysis was limited.

It should be noted that this evaluation assessed the STDP for the period of FY 2002/03 to FY2007/08. Interviewees were asked to reflect back on this time period when providing their

input. However, given the nature of R&D, and the fact the R&D impacts can take years to materialize, impacts that occurred after 2007, but were funded during the evaluation period, were taken into consideration. Also, changes to the design and delivery of the program, resulting from a 2005 internal audit of the Management Framework of the Space Technologies Branch, were also considered when formulating recommendations.

2.3 Limitations of the Evaluation Methodology

Multiple lines of evidence were used in this evaluation to support evaluation findings. However, as is the case in any evaluation, there are some limitations with respect to the methodologies employed. These limitations are described below.

Lack of Comparative Cost Information

The evaluation team was unable to establish the cost effectiveness of the STDP and to compare it with similar delivery models. Given the scope and nature of the STDP's mandate, the consulting team was unable to collect information on comparable programs in other space agencies or organizations. Furthermore, as this is solely a federal jurisdiction, there are no provincial or territorial models with which it could be compared. The uniqueness of the space industry also made it difficult to compare this program to programs in other industries.

Assessing the cost-effectiveness of contracting-out space technology R&D was also a challenge. The nature of space industry and the associated space technologies—the vast spectrum of knowledge required—made it such that it was unrealistic for the CSA to entirely undertake its own R&D. Consequently, commencing a comparison of the cost effectiveness of undertaking internal vs. external R&D was not considered as internal R&D at 100% was not an option for the Agency, or for any major space agency.

Interviewees commenting beyond the evaluation period

As noted above, the evaluation team did advise all interviewees that the evaluation was assessing the STDP for the period from FY2002/03 to FY2007/08. Interviewees were asked to comment on this time period, however, significant changes have occurred to the design and delivery of the program since 2008, and interviewees may inadvertently include their views on these changes in their assessment of the program.

Database Limitations

The STDP currently has an ORIS database that has significant information on each contract (e.g., return on investment, advancement of TRL, jobs created, etc.). However, the information collected for contracts during the review period was limited, although it did address the needs of the program at the time. Basic information on project title, contract value, start/end date were available, however, information on initial vs. actual TRL and jobs created were incomplete. Limited quantitative information about job creation/maintenance, as well as return on investment, created a need to rely on success stories to obtain this information.

Similarly, it was not possible to undertake an econometric study as there was a relatively small number of projects (in comparison to other Industry Canada programs), and there is a restricted market for such projects (not an industry in which products are manufactured and sold in great numbers, for the most part). Consequently, there was not sufficient information to conduct the analysis.

Impacts within CSA

To assess the impact of STDP contracts within the CSA (e.g., reducing risks associated with future missions), GCS had considered sending out surveys within the CSA to better assess how the space technologies developed were used by the Agency. However, during the period under review, the majority of technologies developed were not directly requested by CSA staff, but rather, priority technologies were proposed by industry. Consequently, as there was no specific mission sponsor identified for each contract, a survey of CSA staff regarding the impact that the STDP developed technology has had within the CSA could not be undertaken.

Success Stories

It should be reiterated again, that while success stories enable an analysis of STDP funded contracts that have led to significant impacts for the CSA and the space industry; this technique does not permit the case study findings to be extrapolated to other STDP funded contracts as the sample selection is not random. Therefore, program results (i.e., sales, FTEs, mission-flown technology) described in company 'success stories' are not reflective of all awarded STDP contracts.

Limitations of interviewee responses

Interviews were identified as a key data source for various evaluation questions. However, a key limitation of interviews is that many interviewees were unable to provide detailed responses to the evaluation questions for reasons of: lack of familiarity with STDP developed technology as it may not have been CSA Technology Plan driven, significant changes had recently occurred to the STDP, the evaluation time period was between 2002-2008, etc. The consulting team did try to prepare interviewees by providing the interview guides well in advance of any scheduled interview, and did probe each question. However, there are specific indicators that are not reported in-depth in the report due to limited information provided by interviewees. For instance, CSA employees were asked to assess the efficiency of STDP processes and procedures. Respondents did not report significant issues regarding the efficiency of these processes and procedures and therefore it is only briefly mentioned in the report.

Likewise, interviews were undertaken with a sample of STDP recipients. Respondents were asked to provide details regarding impact of STDP awarded contracts (e.g., number of jobs created/retained, revenues generated from project, etc.). A key lesson learned from producing the success stories is that there is a need for validation of all figures provided by companies. It was noted, that some of the companies were unclear as to which contracts were from STDP and those which were from other programs within the CSA. A significant amount of effort was required to validate figures provided by companies for the success stories. As such, the figures regarding impact of STDP funded contracts that interviewees reported, were not validated, and as such, could not be relied on to make broad statements regarding impact of the STDP.

3. Program Profile

3.1 CSA Priorities

Since its inception in 1989, the Canadian Space Agency has operated through periodic incremental space plans which have allocated specific funding envelopes for well defined initiatives limited both in scope and time. The first such funding element, known as the Long Term Space Plan (LTSP I) was approved in 1986 to provide funding until fiscal year 1993-1994. The second package, known as Long Term Space Plan II (LTSP II) was subsequently authorized for the period from 1994-1995 to 2003-2004.

LTSP II identified, among others, the following thrusts for the Canadian Space Program:

- Priority is to be given to the development and application of space technologies in the areas of Earth Observation and Communications;
- Programming is to be designed to maximize the leverage of federal funding through partnerships and other innovative and flexible financing mechanisms with industry and the provinces to ensure commercial success;
- Implementation of the program should be open to a growing number of firms particularly small and medium enterprises;
- Sustainable industrial regional development to be pursued using the current regional distribution targets as a guideline; and
- Promotion of a growing degree of synergy between civil and non-aggressive defence space activities.

The February 1999 budget announced the government's intention to provide CSA with stable ongoing funding to confer greater flexibility in planning and managing the Canadian Space Program. The budget announcement was endorsed, which authorized the CSA to access funding from the 1999-2000 Supplementary Estimates and adjusted reference levels through 2000-2001 to 2004-2005.

A set of five priority areas of strategic importance for Canada were defined, which would focus the future direction of the Canadian Space Program. These five priority areas are listed as follows:

- Earth and Environment;
- Space Sciences;
- Human Presence in Space;
- Satellite Communications; and
- Generic/Enabling Space Technologies.

3.2 Policy History

The first incarnation of the Space Technology Development Program was established in 1990, which authorized the creation of "a program for industry contracting-out … with planned expenditures of up to $14 million over five years."

The Program was reformulated as the Strategic Space Technology Program (SSTP) in 1994 and funded through the CSA's first Multi-Year Operational Plan (MYOP) in 1995-1996. The SSTP included both an Industry Collaboration Element as well as a Technology Diffusion Element. These two components were implemented to promote collaborative R&D projects between industry, university and government scientists and to encourage the transfer of space technology to non-space applications, respectively.

The contemporary version of the STDP was outlined in the CSA's 1995 Operational Planning Framework (OPF). This document identified the need for a "space technology contracting out program" to support achievement of the space technologies mission statement: "To ensure that Canada remains at the forefront of space technology development in preparation for Canada's future space programs and to enhance Canadian industry's international competitiveness through technology transfer and diffusion."

The CSA's 1995-1996 to 1997-1998 Business Plan established the following objectives for space technology research and development:

- Continued focusing of technology development projects on long-term needs and selected niche markets;
- Development of partnership agreements to lever funding;
- Development of a systematic approach for transferring space technologies to non-space applications; and
- Increased participation of SMEs in the program.

The CSA's 1995-1996 to 1997-1998 Business Plan further established the following objectives for all in-house and contracted-out R&D to be conducted by Space Technologies:

- The letting of contracts to industry and universities;
- An improved response to the technological information needs of the Canadian space community;
- The continued viability of present Canadian niche export industries and the development of new capabilities to maintain Canada's competitive advantage; and
- Increased industrial spin-offs to non-space sectors.

These objectives were further refined in the CSA's 1998-1999 to 2000-2001 Business Plan, which lists the following outcomes for space technology research and development:

- Increased technological capacity of Canadian space industry;
- Enhanced commercial opportunities for Canadian space industry;
- Access to new technologies (through international partnerships);
- Highly qualified personnel;
- Spin-offs to non-space sectors; and
- Support to other CSA activities.

3.3 Mandate and Authority

The mandate of the Canadian Space Agency has three main thrusts that are derived from Article 4 of the Canadian Space Agency Act (1990, c. 13).

Article 4 states:

(4) The objects of the Agency are to promote the peaceful use and development of space, to advance the knowledge of space through science and to ensure that space science and technology provide social and economic benefits for Canadians.

The STDP derives its legislative authority from Article 5.3 (g) of the Canadian Space Agency Act (1990, c. 13).

Article 5.3 (g) states:

(3) In carrying out its objects, the Agency may

(g) enter into contracts, memoranda of understanding or other arrangements in the name of Her Majesty in right of Canada or in the name of the Agency;

3.4 Objectives

The primary objective of the Space Technology Development Program (STDP) is to develop and demonstrate strategic technologies and mission concepts that have a strong potential for having a positive impact on meeting the future needs of the Canadian Space Program and the growth of the Canadian space industry. The STDP accomplishes this objective by putting in place a framework that enhances coherence and pertinence of the indentified needs and opportunities of the CSA, and by the implementation and management of contracted out R&D programs.

The STDP accomplishes its R&D objectives by issuing contracts to Canadian companies, academic entities and not-for-profit organizations, which is consistent with the functions of the Agency specified in Article 5.3 (g) of the Canadian Space Agency Act. Contracts are awarded through either a competitive procurement process or a negotiated procurement process. The Program targets the development of space technologies and mission concepts in areas of priority to the CSA and in areas where Canadian companies require support to develop or maintain new or existing R&D capabilities in areas of priority to the CSA.

3.5 Description

The STDP is segmented into five program elements, which are described as follows:

1. **Mission Concepts**: Supports the development of mission concepts;
2. **Innovative Technologies**: Supports technologies that are in the early development phases and have good potential of having a positive impact on advancing space technology state of the art;
3. **Technology for Future Canadian Missions**: Supports technologies that are in an intermediate development phases and that have a strong potential of having a major impact on future Canadian missions. Emphasis may be given to those technologies that are of critical importance to the successful execution of a mission;
4. **Industrial Capabilities**: Supports technologies that are in an advanced development phases and that have a strong potential on continued growth and capabilities of the Canadian space industry; and

5. **In-Orbit Technology Demonstration**: Supports technologies that are in advanced development phases and have a strong potential for market acceptance but present high technical risk or is mission critical and may present high technical risk.

The five components of the STDP cover a distinct spectrum of Technology Readiness Levels (TRL). TRLs are a systematic metric system that supports assessment of the maturity of a particular technology and the consistent comparison of maturity between different technologies. The TRL scale was developed by the US government and adopted by NASA's Advanced Project Group and are well established tools in the American and European space industry.

The TRL scale is employed by STDP project managers to manage the portfolio of projects to ensure an optimal balance between risk and results. The maximum allowable contract value is proportional to the maturity level and inversely proportional the technical risk of the project. It is important to note that the STDP does not support the development of technologies above TRL 7 (demonstrated in a space environment). The following table lists eligible types of projects, a description of each and corresponding TRL and typical funding level.

ELIGIBLE PROJECTS	TRL	FUNDING LEVEL	TYPICAL MAXIMUM VALUE
Mission Concepts	Concept	Low	$300K
Innovative Technologies	1-3	Low	$300K
Technology for Future Canadian Missions	2-5	Medium	$500K
Industrial Capabilities	3-6	High	$1M
In-Orbit Technology Demonstration	5-7	High	$1M

3.6 Stakeholders

The key stakeholders of the STDP fall into two groups that include the sponsors and influencers of future missions within the Canadian Space Agency as well as the Canadian space industry.

The sponsors and influencers of future missions include personnel from CSA's Space Science, Space Technologies and Space Operations Branches[2]. These individuals are responsible for the planning and development of future missions to be led by the CSA or to be conducted jointly with foreign space agencies such as NASA, JAXA and ESA. Sponsors and influencers are responsible for identifying the technology requirements of their missions and for submitting them to the STDP to ensure that appropriate R&D contracts are issued.

The Canadian space industry includes about 80 firms of which the top five account for more than 70% of total revenues. The CSA is a significant customer for many of these firms, largely as a result of the contracts issued by the STDP. Firms and companies within the Canadian space industry are responsible for submitting bids on RFPs issued by the STDP and for delivering completed R&D projects according to the terms and conditions of awarded contracts.

[2] These branches were part of CSA's former organizational chart, wich was in effect until March 31, 2010. The nomenclature associated with this former organizational chart is used throughout the remainder of this report, in order to reflect CSA's organizational structure during the evaluation period.

3.7 Resources

From FY02/03 to FY 07/08 the program spent on average $12.7M/year. The following table provides a breakdown of the budget and actuals over the review period. Over the last five years, the average number of projects that have been awarded in a given fiscal year was 40. The maximum contract value has been in the order of $1 million with the lowest at $100,000.

Fiscal Year	Workplan Budget	Actuals (O&M) (end of year)	Salaries (exclus EBP)	Total Actuals Spent on R&D Contracts
2002/2003	$ 9,311,000.00	$ 9,834,843.88	$ 721,870.00	$ 9,670,026.76
2003/2004	$ 9,404,000.00	$ 8,789,090.64	$ 832,885.00	$ 8,580,508.03
2004/2005	$ 15,681,000.00	$ 15,211,549.20	$ 801,617.00	$ 15,038,507.21
2005/2006	$ 12,270,000.00	$ 15,057,751.76	$ 728,086.00	$ 14,832,881.56
2006/2007	$ 13,245,000.00	$ 12,221,043.47	$ 824,721.00	$ 11,958,157.31
2007/2008	$ 13,955,408.00	$ 14,925,843.04	$ 958,968.12	$ 14,553,970.31

The table above includes the salary of the STDP staff (average of 6 FTE) plus matrixed part time experts (the equivalent of .05 of their time per contract). The Program also relies on the Agency's Corporate Services as required, such as those provided by the procurement office as well as services from Public Works and Government Services Canada (PWGSC) for matters relating to procurement, project planning, solicitation, contract award and contract administration. Due to the broad scope of R&D subjects, the program also relies on technical and scientific experts to evaluate proposals and to act as Technical Authorities on awarded contracts. During the evaluation period the program lapsed an average of 3% of funds. The amount that the program has lapsed does vary by fiscal year, with the program lapsing approximately 8% in FY 2006/07 and over spent by 22% in FY 2005/06.

3.8 Governance

Overall responsibility for the STDP rests with the Technology Management and Applications (TMA) Directorate which is part of the Space Technologies Branch. The roles and responsibilities of the key STDP team members are summarized in the following Responsibility Assignment Matrix (RAM).

ROLES	RESPONSIBILITIES
DG Space Tech.	• Approves technology priority list • Approves evaluation results
Director, TMA	• Provides direction on program policy and results • Governs the functions of technology planning • Formulates work plan and operational plan • Approves program performance targets • Approves competitive process results reports • Manages budgets • Develops outreach strategies
Procurement Officer	• Provides advice and support for procurement strategies, plans and documentation • Manages and coordinates solicitation
Program	• Develops the procurement projects charter

ROLES	RESPONSIBILITIES
Manager/Authority	• Seeks and secures approval and budget to initiate procurement projects • Acts as the program spokesperson for respective sector, liaising with other branches of the CSA, other federal and provincial organizations, the industry and the research community • Acts as the STDP main point of contacts • Governs STDP priorities and directions • Manages and coordinates evaluation • Produces evaluation results report • Provides approval for procurement projects • Manages funds and human resources • Oversees Project Authorities
Project Authority	• Manages the awarded projects following the STDP Standard Operating Procedures, CSA Policies and Procedures related to contract administration and management, TBS Contract Management Policies and PWGSC Procurement and contracting Policies • Controls contractor performance in respect to contract terms and conditions • Formulate project status report and provide timely quality information to program managers • Implements program management processes including the monitoring of performance indicators • Participates in the evaluation and selection of proposals • Provides analysis and recommendations to Program Authorities in terms of priorities, issues and opportunities • Organizes and/or participates in events providing visibility into STDP activities and results, e.g., industry days, info days, workshops, symposiums, conferences
Scientific Authority	• Provides scientific and technical support for the evaluation of R&D proposals from industry, academia and NPO • Controls contractor performance in respect to contract terms and conditions • Provides scientific and technical analysis and recommendations during contract management
Program Support	• Provides support to the Program Managers, the Project Authorities and the Procurement Project Manager in implementing the STDP • Produces regular program financial status

3

3.9 Delivery Approach

There are six main stages that an STDP project must go through during its life cycle that include: the selection of priority technologies; initiation and formulation of the procurement project; solicitation; project evaluation, selection and contract award; project management; and contract close out and post contractual obligations. A short explanation of each stage is provided below:

1. **Selection of Priority Technologies (Strategic Planning)**: This category includes all STDP activities leading up the identification of a list of priority technologies to be included in all STDP RFPs and contracts for the coming year.
2. **Initiation and Formulation of the Procurement Project**: This is the first stage in the project's life cycle. It begins with the decision to initiate a procurement project to the development of the request for proposal (RFP) complete with evaluation criteria;
3. **Solicitation**: This stage begins with the public announcement of the RFP to the receipt of proposals submitted by industry;
4. **Project Evaluation, Selection and Contract Award**: This stage begins with the verification of proposals against mandatory criteria. Major activities performed during this stage include the detailed evaluation of proposals by the Evaluation Committee, selection, negotiation, contract award and issuance of a communiqué;
5. **Project Management**: This stage begins with the kick-off meeting and pertains to the conduct of project management and monitoring tasks, including reviews, scientific support, reporting, ensuring that proper controlling processes are in place, approval of deliverables and payments of invoices including final payment. This stage ends when the contract is finished and funds have been disbursed; and
6. **Contract Close Out and Post Contractual Obligations**: Upon completion of all contractual activities and milestones, this stage is triggered by the release of the final payment transfer from the CSA indicating that the CSA's financial and contractual involvement in the project has formally ended. Projects can also be terminated due to default or non-performance. Project closure activities include reporting on performance indicators and on project performance. Commercialization activities may continue beyond the project termination.

The STDP has developed a manual of Standard Operating Procedures (SOPs) to describe the general procedures to be carried out by personnel in the implementation of projects. The SOPs are intended to serve as guidelines to Project Officers (POs) and Program Managers (PMs) with the objective of providing a useful reference to assist them in the day-to-day management of projects.

3.10 Logic Model

A logic model is an essential component of any evaluation framework. The logic model delineates the specific elements or activities and outputs of the initiative as well as the associated results (a.k.a. outcomes or impacts). In so doing, it summarizes the structural logic of the program by presenting the linkages between the primary activities, the results they are intended to achieve and how these results contribute to the broader objectives of the program. By clearly illustrating the intended results of the initiative, the logic model serves as an invaluable tool for the ongoing and future assessment of program success.

A logic model for the Program was articulated in the STDP management framework, which was finalized in March 2007. However, it should be noted that this logic model was largely designed to conform to the expected results articulated in the CSA's Program Activity Architecture (PAA). Furthermore, the outcomes in this logic model are not solely attributable to the STDP but, rather, apply to a number of similar programs that are characterized as "generic space technologies."

Although the original logic model is useful for corporate reporting purposes, a logic model that clearly identifies outcomes that are specifically targeted by the STDP is required for evaluation purposes. A revised logic model for the STDP can be found in Appendix F. This version serves as the basis of the following evaluation plan.

3.10.1 Activities

Activities are defined as operations or work processes internal to an organization, intended to produce specific outputs (e.g. products or services). Activities are what the Program does on a daily basis and, as such, are not directly measured. All of the components follow an identical series of activities in the management and administration of the Program. The revised logic model identifies three main categories of activities for the STDP:

1. **Management of the Strategic Planning Process:** This category includes all STDP activities leading up the identification of the key areas of investment for the STDP's yearly contracts;
2. **Management of the Procurement Process:** This category encompasses all STDP activities required to initiate and manage the Request for Proposals (RFP) process, to select winning bidders and award contracts; and
3. **Management of Awarded Contracts:** This final category includes all STDP activities for the management and administration of awarded contracts such as the management of deliverables, financial elements of the contracts and accountability requirements such as final reports.

3.10.2 Outputs

Outputs are defined as direct products or services stemming from the activities of a policy, program or initiative, which are delivered to a target group or population. Outputs are directly measured and should provide a sense of the quantity or volume of activities undertaken by the Program. The revised logic model for the STDP has identified outputs associated with the three major activity streams:

1. **Balanced Portfolio of STDP Projects**: The first output anticipates that STDP strategic planning activities will result in a balanced portfolio of contracts. Please note that the STDP defines a balanced portfolio as follows:
    - Ensuring that the portfolio of STDP R&D projects is representative of the CSA's priority sectors (i.e. earth observations, space communication, etc.)
    - Ensuring the diversification of the portfolio in terms of the Technology Readiness Level of its R&D projects

- Ensuring that the needs of CSA mission sponsors and influencers are balanced with the needs and capabilities of the Canadian space industry

This output is linked with the activities related to the management of STDP's strategic planning process;

2. **R&D Contracts Responding to Identified Priority Needs**: The second output reflects the expectation that value-added will be generated by the STDP R&D contracting process through contractors' knowledge, insight, information and clarifications in terms of R&D options, technological possibilities and requirements for the R&D contracts the STDP has awarded them. This output is linked with the activities related to the management of STDP's procurement process;
3. **R&D Products and Services Delivered**: Given the Program's focus on procurement activities, the third output for the STDP is that contract terms and conditions are respected according to initial or negotiated specifications. This output is linked with the activities related to the management of STDP's contract management process.

3.10.3 Outcomes

Outcomes are defined as an external consequence attributed to an organization, policy, program or initiative, which are generated as a result of its activities and outputs.

3.10.3.1 Immediate Outcomes

The two immediate outcomes for the STDP are described as follows:

1. **Increased Technological Capacity of the Canadian space industry**: It is expected that the award of R&D contracts to companies in the Canadian space industry will help them to develop new technologies that will further their innovative capacity.
2. **Increased Knowledge Required for Existing and Future Space Missions**: It is expected that the R&D contracts completed by the Canadian space industry will provide CSA mission sponsors and influencers with access to the knowledge they require to plan, develop and implement existing and future space missions.

3.10.3.2 Intermediate Outcome

The two intermediate outcomes for the STDP are described as follows:

1. **Reduced Risks Associated with CSA Missions:** It is expected that the costs and risks associated with the CSA missions will decrease as the technology, knowledge and concepts developed and enhanced by STDP projects are applied to future missions. The STDP also enables potential new missions as a result of the new technologies and industrial capabilities that are created by the program; and
2. **Economic Viability of the Canadian space industry:** The contracts awarded through the STDP are expected to allow the Canadian Space Sector to maintain and/or enhance its economic viability and industrial capabilities. This would be achieved through the knowledge, information, experience and technologies developed or further enhanced thanks to the awarded contracts.

3.10.3.3 Ultimate Outcomes

The ultimate outcome of the STDP is described as follows:

1. **Socioeconomic Benefits for Canadians**: It is expected that the research and development projects funded by the STDP will allow the CSA to undertake new and existing missions whose results will generate significant socioeconomic benefits for Canadians. Furthermore, Canadians will benefits from the increased competitiveness and economic viability of the Canadian space industry through increased employment, investment and contribution to the Canadian economy. It should be noted that the ultimate outcome is consistent with one of the three main statements that comprise the CSA mandate.

4. Findings

This section of the report presents evaluation findings and conclusions by the four broad evaluation groupings of program relevance, design and delivery, program success, cost-effectiveness/alternatives.

4.1 Program Relevance

The findings of the evaluation of the STDP on the issue of program relevance are presented in this section of the report. The evaluation question which was considered in addressing the issue of relevance was as follows:

- Does the program area/activity continue to serve the public interest?

In order to assess whether the STDP continues to serve the public interest, a series of sub-questions need to be considered. They include:

- Extent to which the program is linked to a Government priority
- Extent to which the program is achieving its mandate & objectives
- Extent to which the program addresses a demonstrable need
- Stakeholders required STDP support to achieve their objectives

Finding: *In terms of the alignment of the STDP to Government priorities, the link clearly exists.*

The *Canadian Space Agency Act* requires the Agency to 'plan, direct, manage and implement programs and projects relating to scientific or industrial space research and development and the application of space technology'. The establishment of the STDP permits CSA to fulfill this function by developing and demonstrating strategic technologies and mission concepts that have a strong potential for having a positive impact on meeting the future needs of the Canadian Space Program and the growth of the Canadian space industry. There is also alignment to CSA's initial Long-Term Space Plan (LTSP) which noted that 'an on-going research and development effort in strategic technological areas is at the core of a successful space program and is required to stay abreast of, and fully benefit from, rapid developments worldwide'.

While the evaluation of the STDP was for the period of 2002 to 2007, the program continues to align to current Government Priorities. Canada's Space Strategy (LTSP III) also highlights the two key intermediate objectives of the STDP: 1) the CSA will continue to foster the growth of a viable, vibrant space industry in Canada; and 2) the Agency's advanced research and development will create new technologies…that will reduce the risks associated with their use or the cost of their production. Also, the current federal Science and Technology Strategy, *Mobilizing Science and Technology to Canada's Advantage* (2007), also provides guidance on Canada's science and technology policy—with the focus of making Canada a world leader in science and technology and a key source of entrepreneurial innovation and creativity. As noted in the Strategy, CSA remains one of the largest R&D performers among federal science-based departments and agencies.

Finding: *Based on the evidence from this evaluation, the STDP has met its mandate and objectives.*

The mandate of managing contracted out R&D and the objectives of developing strategic technologies and mission concepts that will have an impact on meeting the needs of the Canadian space program and the growth of the Canadian space industry have occurred. However, during the period under review, the primary focus of the STDP was on the commercial viability of the Canadian space industry. Decreasing risks associated with the development of Canadian missions was, to a lesser extent, attained. During the period under review, contracts were mainly used to support the growth of the Canadian space industry. At times, the Agency would release Technology Plans which identified known future Canadian space missions and their technology requirements. Even though various Technology Plans were produced they did not provide sufficient information to guide the STDP. For instance, there was not sufficient detailed information on the prioritisation of the technology, the evolution of TRL needed, the time required to develop the technology, etc. Also, there was limited awareness of these plans within the CSA. Few CSA interviewees were aware of the plans, and if they were, noted that they were not relevant.

Throughout the period under evaluation (FY2002/03 to FY 2007/08) the STDP actively sought input from both within the CSA and externally from industry regarding the identification of future space technology priorities. Input from within CSA was limited, and when provided, quite broad in nature with limited information regarding missions, timelines, technology readiness levels, etc. Industry appeared better positioned to identify technologies, and would put forward ideas and suggestions. Consequently, the technology priority areas presented in requests for proposals (RFPs) were based primarily from input received from the Canadian space industry.

Supporting the Canadian space industry was viewed internally within the CSA, as contributing to the CSA meeting its objectives. Specifically, the creation of a relatively stable market for space technologies in Canada would ensure that when CSA required assistance from industry, that the expertise and knowledge would exist; thus, ensuring that the Agency would be capable of responding to its needs in space and remain a recognized leader in the global market. Governments worldwide are the main regulator and user of national space systems, and will want to influence the activities of the space industry, such that their space program needs are met. Likewise, industry relies on government space budgets to fund advanced technology research and development initiatives, as space technology R&D is costly and risky and the return on investment can be low given the small space market. According to the CSA, the report on the State of the Canadian Space Sector 2008 notes that in 2008 the Canadian Space Sector generated $2.794B in revenues. These revenues far exceed the total budget spent by Government for space. According to the CSA report "Economic Impact Analysis of the Canadian Space Agency Fiscal Year 2003/04, conducted by DB Geoservices Inc. in association with KEYSTEP Growth & Finance, the CSA spent $280 million in total, out of which $154 million was contracted out.

The STDP began focusing primarily on attaining the program objective: “supporting the growth of the space industry” and less on meeting the objective of “meeting the needs of the Canadian space program”, even prior to the commencement of the evaluation period. In the early 90s, the focus of the program was on promoting collaboration and encouraging the transfer of space

technology to non-space applications. In the mid-90s, according to CSA's business plans (FY 95/96 to 97/98) the focus was less on collaboration but more on the development of technologies and for the continued evolution of the technology to non-space applications. By the late 90s, CSA's business plan (FY98/99 to FY00/01) emphasized the need to increase capacity within the space industry. This shift in the STDP objectives, just prior to the evaluation period, provides some context regarding the shift to providing assistance to the Canadian space industry and less on the reduction of risks of future space missions.

Finding: *There was universal agreement on the continued need for this program, and industry interviewees also noted that the STDP contributed to advancing company objectives.*

Both industry interviewees and CSA interviewees noted the importance of this program in supporting the Canadian space industry. Space technology R&D is high risk and the return on investment is low given the small market for the technology (e.g., only a handful of Canadarm's have been sold). STDP contracts enable the Canadian space industry to engage R&D resources which contribute to increasing capacity within the industry. The development of space technologies and the patents for those technologies, as evidenced in the success stories, have permitted various Canadian space companies to increase revenues based on the commercialization of the technology. The majority of industry recipients indicated that absence of the STDP would result in a smaller Canadian space industry as fewer companies would be able to undertake research in this domain. As well, the R&D budget for many companies would be greatly reduced as companies would not have STDP contracts to augment their R&D budget. If less R&D were conducted, the pace of technological advancement would be negatively impacted.

When industry respondents were asked if the STDP funding/contracts played a critical role in the development of space technologies, two-fifths (39%, n=7) of industry interviewees indicated that their company would not have undertaken the R&D had they not received STDP support. One-half (50%, n=9) indicated that the level of research would have been limited (i.e., could go forward with one project but not another), and one-tenth (11%, n=2) indicated that it would have taken longer to undertake the research.

While industry has argued the need for the program, CSA interviewees also acknowledged that the Agency does not have the internal capacity (e.g., expertise, FTEs) to meet the technological objectives of future Canadian space missions (missions funded by the Government of Canada either nationally or as part of an international collaboration). The breadth of space related R&D that needs to be undertaken to meet the Agency's needs are too vast and the current internal capacity does not exist. Interviewees had acknowledged that CSA should also maintain an internal R&D component as it ensures that CSA scientific staff have the expertise needed to assess and monitor external R&D contracts. This is supported by the Canadian Space Strategy (LTSP III) which acknowledges that most of the national technology base will reside and be developed in industry, but that the Agency will need to have sufficient in-depth understanding of technological advances in order to provide judicious stewardship of Canada's national space program. Consequently, the STDP enables the CSA to meet its long-term space strategy. According to CSA respondents the absence of the STDP would result in loss in CSA capacity as

a consequence of less space technology R&D being undertaken. As a result, increased mission risk and increased reliance on other countries for technologies would result.

Industry Canada's *National Aerospace and Defence Strategic Framework: The Canadian Industry to 2025* also recognizes that public procurement in the aerospace sector is of key importance to both government and industry. For government, procurement enables the attainment of various goals, including: support for technology creation and development, commercialization, skilled labour, and national control over sensitive technologies, etc. For industry, 'stable and well-managed domestic procurement enables it to make strategic investments in capital equipment, processes, training and R&D, and helps ensure that Canada maintains a high-value-added economy that can compete for global markets as well as an industrial base that can support our national needs. Firms find "home" country procurement essential for access to the international marketplace since this is seen as a sign of a firm's credibility.'

The importance of the space industry is also evidenced through Canada's Economic Action Plan as the federal government aims to support the development of advanced robotics and other space technologies by providing $110 million over three years to the CSA.

Both industry and CSA interviewees were asked what would be the impact if the STDP no longer existed. The primary response was that the Canadian space industry would continue to exist in the short-run, but within the next ten years it is likely that the industry would be half of its current size. A smaller Canadian space industry would make it more difficult for the Agency to achieve its objectives, as there would be fewer companies that the CSA could engage to

CONCLUSION:

The STDP continues to be relevant as evidenced by its alignment with Government of Canada priorities, the objectives of the Canadian Space Strategy and the mandate of the CSA. While the STDP has met its objectives, its focus has predominantly been, during the evaluation period, on assisting the Canadian space industry. In fact, there was universal agreement that the program has supported the industry. However, given that this is a contract-out program, the STDP needs to prioritize and focus on the objective of reducing risks associated with space missions, especially as it does not have the internal capacity to undertake all necessary space technology R&D.

4.2 Program Design and Delivery

The findings of the evaluation of the STDP on the issue of program design and delivery are presented in this section of the report. The evaluation question which was considered in addressing the issue of program design and delivery was as follows:

- Does the STDP's design and delivery allow the program to effectively achieve the program's objectives?

Findings are presented under four broad categories that reflect STDP design and delivery.

Procurement & Contracting

Finding*: During the evaluation period, STDP contracts had some of the characteristics of financial assistance to third parties rather than true procurements of goods and services. CSA has resolved this issue as it is planning on establishing a new Gs&Cs program and providing training to STDP personnel. A lack of shared understanding of the process requirements in CSA and PWGSC has resulted in significant delays in contracting and procurement.*

The STDP is a contracted out R&D program which should issue contracts in response to identified needs and opportunities. A 2005 internal audit noted that STDP service contracts had some of the characteristics of financial assistance to third parties rather than true procurements of goods and services. Although, there was limited direct demand within the CSA for the majority of the industry proposed technologies, the Agency considered issuing contracts for the purpose of supporting the Canadian space industry as being a benefit to the CSA in the long-run. The presence of a relatively stable industry for space technologies in Canada, capable of responding to CSA's needs in space, was a priority. In response to these audit findings, the CSA is planning on establishing a class Grant and Contribution Program (G&C Program). The new Terms & Conditions of the CSA Class G&C Program were approved by TBS on October 1st, 2009. The new program will be comprised of two components: a) Research, and b) Awareness and Learning. The Research component will provide financial support to organizations to conduct space-related research and development in priority areas. It will support targeted knowledge development and innovation to sustain and enhance the Canadian capacity to use space to address national needs and priorities in the future. The Research component of the G&C program will ensure that companies in the Canadian space industry, that relied on the STDP for R&D funding to further technological advancement even though it did not directly meet a CSA need, will have access to funds. The STDP, and other programs within the CSA, will have the authority to issue contributions to industry (the mechanism was not available to the STDP during the period under review).

Changes that have come about as a result of the 2005 internal audit, has also resulted in STDP staff receiving more in-depth training to ensure that they have a fulsome understanding of the contracting requirements of their program.

Industry recipients were asked to assess various elements of the STDP contracting process (e.g., reporting, fairness, etc.). Aspects that industry interviewees were most satisfied with, a rating of 4 or 5 on a 5pt scale, included:

- 84.2% were satisfied with the clarity of the reporting requirements to CSA
- 62.5% were satisfied with the fairness of the selection process
- 52.9% were satisfied with access to STDP contracts

Few respondents were dissatisfied with these aspects of the contracting process. Respondents were either satisfied or indicated that they were somewhat satisfied (a rating of 3 on a 5 point scale). However, issues were raised by some respondents. It was noted that the process favoured larger companies that had a history with the STPD. Larger companies, that had dedicated staff committed to writing proposals and which had experience in the writing of proposals, were viewed as more likely to win bids over smaller companies that had neither the expertise in the writing of proposals or were challenged in finding the time to write a bid that met the needs of the CSA. Smaller companies would have greater difficulty overcoming the learning

curve regarding proposal writing due to the infrequency of RFP issuance. There were also several comments regarding the overall administration costs associated with the STDP contracting process. As one company had noted: "*They have not bid on $200K projects because it costs them $60K to write the proposal and an additional $100K for administrative requirements of the project*". Another company had noted that "*one-quarter of project funds were dedicated to reporting back to the CSA*". Overall, the cost and expertise to prepare proposals, and the cost associated with reporting requirements, limited some companies' participation/access to the STDP.

The cost associated with the contracting process also relates back to the overall amount of time needed to address CSA's reporting requirements. When asked, two-fifths (42.1%) of industry interviewees indicated that they were satisfied (rating of 4 or 5 on a 5 point scale) with the time required to address project reporting requirements. One-fifth (21%) indicated that they were not satisfied (rating of 1 or 2 on a 5 point scale), and over one-third (36.8%) indicated that they were somewhat satisfied.

Interviewees within the CSA (STDP personnel and other CSA staff) and external to the agency were asked to comment on whether STDP processes and procedures were functioning efficiently. There was general agreement that the current contracting process (adherence to regulations, RFP, selection criteria, etc.) was well established and functioning efficiently. All proposals are reviewed by three experts of that technology within the CSA. The process is considered neutral and staff are able to supply justification for all ratings. It was noted that there is an opportunity to better streamline the process by automating various aspects, including submission of reports electronically. Currently staff must manually enter all reports received. PWGSC and CSA have also developed standard clauses for RFPs which should contribute to improving the overall efficiency of the process.

In analysing the breakdown of contracts, RFP vs. directed, during the period under evaluation, there was a high percentage of directed contracts during FY03/04 (60.9%) and FY05/06 (87.5%). In fact, in reviewing the total number of contracts issued over the six year period, close to one-third (32.1%) of contracts were directed. Directed/sole source contracts should be used where submission of a proposal via an RFP is inappropriate, such as opportunities where specific Canadian space companies are invited to participate in an international cooperative venture that require a response within weeks or the technology required is specific to the company. These contracts are intended to bridge the gap to the next general call for proposals. While not a key issue noted by industry interviewees, the relatively high percentage of directed contracts may contribute to a perception of bias in the awarding of contracts.

Contract	FY 02-03	FY 03-04	FY 04-05	FY 05-06	FY 06-07	FY 07-08	Total
RFP	73.2%	39.1%	79.7%	12.5%	92.7%	75.7%	67.9%
Directed	26.8%	60.9%	20.3%	87.5%	7.3%	24.3%	32.1%
Total	100%	100%	100%	100%	100%	100%	100%

Industry interviewees were asked to rate their satisfaction with the efficiency of the RFP process.

Slightly over one-quarter (26.3%) of industry recipients indicated that they were satisfied, rating of 4 or 5 on a 5pt scale, with the efficiency of the RFP process. In fact, over one-half (52.6%) indicated that they were not satisfied. Respondents noted the inconsistency in the issuance of the

RFP and the delay between the submission of proposals to the awarding of contracts (i.e., months). The table below highlights that RFPs are not issued at regular timeframes. In reality, the STDP is a contracting-out program that should only be issuing contracts in response to identified needs/opportunities. However, industry interviewees noted the challenges of retaining a workforce in expectation of future STDP-related work.

STDP RFP Data	**RFP 2003**	**RFP 2004**	**RFP 2005**	**RFP 2006**
RFP Posting	March 2003	December 2003	August 2005	May 2006
RFP Closing	May 2003	February 2004	October 2005	July 2006
First Contract Award	September 2003	September 2004	April 2006	February 2007
Last Contract Award	February 2004	March 2005	June 2006	March 2008

Source: Technology Development Group, Year End Report 2007-2008

Once companies submit their proposals they are bound to have the necessary resources available to commence work from the contract award. The certification requirements of any bid notes that the bidder 'will be available to commence work within a reasonable time from the contract award, and will remain available to perform the work in relation to the fulfillment of this requirement.' This condition can place hardship on a company, as they need to retain resources in expectation of future work. One industry interviewee had noted that had they known that it would take six months to receive a STDP contract, they would have laid-off staff. Financials (the bottom line) are important to companies who have to justify to shareholders the retention of staff when work is not available.

Delays in the issuance of contracts can also lead to technologies becoming less strategic due to time sensitivities. The space industry, similar to many other industries, is competitive. The sooner that a technology is brought to market, the more likely that the product can secure its market share. Delays in the development of technologies may make the technology less relevant or redundant based on other technologies arriving to market sooner. As one interviewee noted, to win a contract, a company must demonstrate that the technology is critical to their strategic direction, but if it takes a year to be awarded a contract than there is fundamental conflict—how do you justify a year of waiting with the argument that the technology was strategically important? One interviewee had noted that it took 9 to 10 months to get a contract in place even after they had been advised that they had won the contract.

While STDP and PWGSC are attempting to facilitate the contracting process, delays are occurring from a lack of a shared understanding of the process requirements of each party. For instance, the STDP has forwarded to the PWGSC contracting office next to final draft of the request for proposals (RFP) in order to expedite the process. However, the contracting office does not consider obtaining drafts as a means of expediting the process. In fact, when the final draft RFP is submitted they will review the draft from scratch even though there are minimal changes from the initial draft submitted by the program. These processing issues are resulting in significant delays. As evidenced in the table above, in 2006 there was a year delay between

when the first STDP contracts were awarded to the last contract awarded. A joint working group has been established between CSA and PWGSC. While the working group is looking at more than just the STDP, the outcome of the work of the working group could in principle help the delivery of STDP by establishing better processes and service standards between CSA and PWGSC for R&D contracts and other contracting services.

Project funding and contractor's contribution requirements have varied depending on the year that the RFP was issued. For example, the 2006 STDP RFP indicated that the CSA contribution for STDP contracts could not exceed 70% of the total project value, thus requiring the bidder to contribute the remaining 30%. The consulting team reviewed contracts that did not meet minimum RFP industry requirements. Of the total 26 contracts that were found to have zero industry investment, 6 were justified by the RFP requirements (e.g., mission concept projects not requiring industry contribution). Therefore, 22.6% of the 93 contracts considered may not have respected the RFP requirements. It is unclear why these contracts did not meet RFP industry investment requirements.

Requirement in RFP for industry investment	Number of contracts with zero investment from industry
2000	1
2002 – minimum 15 to 25%	1
2003 – 0% for mission concepts, and then 10 to 35% for others	(6: 3 of which were focussed on innovation but no mission concepts)
2004 – 10% to 40%	(7: 3 of which were focussed on innovation
2005 – 30%	2
2006 – 0 (innovation) to 30% (industrial capacity) minimum	9: 6 of which were focussed on innovation).

Technological Direction

Finding: *Overall, no formal prioritization of space technologies.*

As noted under the relevance section, industry input was the main guidance in identifying priority technologies. The CSA 2004 Technology Plan did not provide the STDP with sufficient information to accurately assess the priorities and long-term requirements of the Agency. The prioritized list of technologies, identified by the STDP, was based primarily on input from industry. This list was used by the STDP to put forward RFPs.

There is the perception that companies with the strongest links with the CSA, their priorities, would be best represented in the RFPs to the potential detriment of other businesses and to CSA itself. In fact, over one-half (52.9%) of industry recipients indicated that they were only

somewhat satisfied (rating of 3 on a 5 point scale) with the involvement of the Canadian space industry in the selection of priority technologies, while over one-quarter (29.4%) indicated their satisfaction (rating of 4 or 5 on a 5 point scale). Although the consulting team asked interviewees to provide an assessment of the STDP for the period of 2002 to 2007, numerous changes have recently occurred to the program, which may have influenced respondents' assessment of the program. The 2005 internal audit noted that some STDP contracts had the characteristics of financial assistance to third parties rather than true procurements of goods and services; therefore, the CSA is currently developing an ever-greening Technology Plan that reflects the needs of the Agency. At this point, input from industry is more restricted. Consequently, industry interviewees, as a result of these changes, appeared less satisfied with the current STDP approach and this may be reflected in their response.

The CSA has now placed a spotlight on developing a Technology Plan that will meet the needs of the STDP, and more specifically, the CSA. The technology plan should become an ever-greening document that provides the necessary guidance to permit STDP to issue space technology development contracts that meet the needs of the Agency. The current Technology Plan form will collect information on: the technology, the targeted mission, justification as to why the technology should be developed in Canada, timelines, technology priority level (urgency/criticality), TRL, and most especially the technology requestor within the CSA. The Technology Plan is being developed by Technology Requirements and Planning Group. STDP will no longer need to develop the list of priority technologies, but will implement the plan provided to it.

Management

The STDP, during the evaluation period, was run by four managers responsible for different sectors and elements. This matrix approach to the management of the program was not always ideal. For instance, there was a revolving responsibility for the preparation of the RFPs which may have led to some of the inconsistencies and difficulties in working with PWGSC (i.e., delays in the issuance of RFPs) over the years. Agreed upon changes, between CSA and PWGSC, to clauses in RFPs would not necessarily be reflected in the issuance of subsequent RFPs which would now be under the responsibility of a different STDP manager. This would create delays as the revised clauses would need to be included. Currently, the STDP is run by one manager. This provides greater consistency in the overall STDP approach.

There was also consensus within the Agency that the centralization of space technology R&D contracting within the STDP contributes to a reduction in duplication of effort and R&D undertaken. During the evaluation period, STDP coordinated input from industry and to a lesser extent within CSA, to identify priority technologies to be included in a single RFP. As a consequence of coordinating the issuance of contracts, the STDP is positioned to provide advice on what technologies have been delivered. Today, STDP is guided by the current CSA Technology Plan for the identification of priority technologies for inclusion in the RFP. The STDP management structure is more objective as the technology priority-setting is undertaken outside of the program.

Knowledge Transfer

Finding: *STDP did not actively transfer project findings within the CSA – as there was no direct internal technology requestor.*

Given that the RFPs predominantly reflected the space technology priorities of the Canadian space industry, and that there was no internal CSA requestor for that technology, when project reports were submitted to the program they were not forwarded within the Agency. Final project reports remained with the STDP. Consequently, much of the knowledge generated through the STDP was not transferred within the Agency. In fact, CSA interviewees, outside of the STDP program, were challenged in identifying technologies generated through the STDP that were used within the Agency.

CONCLUSION:

Although the internal audit identified that many of the STDP contracts, during the evaluation period, as having some of the characteristics of financial assistance to third parties rather than true procurement of goods and services, training of STDP personnel and the establishment of a formal updated Technology Plan will permit the STDP program to focus on achieving its primary objective of reducing risks associated with future missions. The program's secondary objective, strengthening the Canadian space industry, will result from focusing on the program's primary objective.

Issues regarding the efficacy of the procurement and contracting processes are costly to both CSA and to industry as time sensitive R&D is being delayed. These delays have a negative impact on the ability of the STDP to achieve its objectives, and affects companies ability to effectively utilize their workforce. The joint CSA/PWGSC working group should result in better processes and service standards. The infrequency of RFP issuance may also present challenges to companies less familiar with the process of responding to contracts. Tools may need to be developed to assist companies less familiar with the STDP process. Also, to ensure greater participation by industry, the STDP could consider the viability of a two-step application process (i.e., letter of interest detailing the technology and a complete proposal if requested).

4.3 Program Success

The findings of the evaluation of the STDP on the issue of program success are presented in this section of the report. The evaluation questions which were considered in addressing the issue of program success were as follows:

- How has the STDP positively contributed to the development of the economic viability of the Canadian space industry?
- How has the STDP contributed to reducing the risks involved with CSA missions (failures, time, resources) and/or made new missions possible?
- To what extent has the Canadian space industry increased its capacity over the years thanks to the technology development contracts granted by the STDP?
- To what extent has the CSA increased its capacity over the years thanks to the technology required for the development and planning of new or current space missions thanks to the STDP?

Findings: *The STDP has positively contributed to the development of the economic viability of the Canadian space industry by increasing human resource capacity and increasing overall revenues*

Based on interviews and success stories, the STDP positively contributed to the development of the economic viability of the Canadian space industry. In fact, all industry recipients (100%, n=17) indicated that the STDP contributed strategically to the commercial viability of the Canadian space industry. When asked to comment on STDP's contribution to the commercial viability of their organization (i.e., space technology component of their organization), three-quarters (73.7%, n=14) of industry recipients indicated that the program had contributed strategically. In fact, one industry interviewee noted that STDP funding helped their organization survive peaks and valleys between contracts and that the funding helped their company maintain employment, although it does not sustain employment. Other comments from industry interviewees include:

> *"Space business is difficult because of the very long development cycle (all TRL). The organization would not have been able to afford it without funding. Even if CSA is not the largest agency, it is important for the funding to support it".*
>
> *"Industry requires the support to proceed with technology due to the high natured specialization of the space industry. STDP plays an important role in the application process mainly through funding/applying expertise on how technology can be applied. STDP plays a prominent role particularly until the maturation stage of the technology."*
>
> *"From one project – many technologies have developed as a result. Project would not have started if did not have the funding. The brainpower was there, but did not initially have the funding to bring it to the level needed. STDP helped get it started. For the second mentioned project –the funding and support helped expand the technology into the commercial market. It would have been hard to reach that market if did not have the support of the STDP."*
>
> *"STDP is one of the main reasons Company is a success in international markets. They can compete against products developed by other space industries such as NASA and ESA… so to compete effectively need to level playing field - STDP does that."*

STDP contracts were viewed by industry recipients as being instrumental (rating of 4 or 5 on 5pt scale) in:

- Accessing new business opportunities internationally (88.8%)
- Accessing new business opportunities nationally (66.6%)
- Developing/strengthening new/existing business alliances (68.4%)

Interviewees had noted that their involvement with STDP/CSA funded technology projects provided their companies with credibility nationally/internationally, and ultimately access to other markets/space agencies.

> "*Definitely large positive impacts were felt. The STDP contracts were a very good vehicle for getting our name out through connections and opportunities. The company*

participated in a lot of technology working forums and connections were also established with foreign space agencies i.e. NASA, European Space Agency (ESA), Japanese Space Agency, and private companies in the United States (direct introduction by STDP)."

"When you say that you've done work for CSA, it gives you credibility".

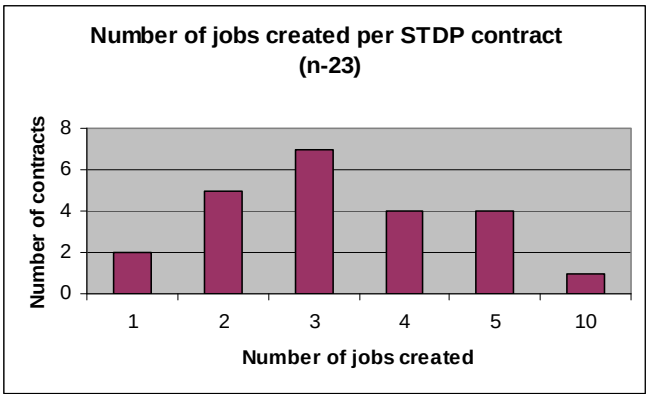
All industry respondents (100%, n=14) indicated that STDP provided their companies with financial leveraging opportunities. Interviewees noted that companies could undertake more R&D, as they are not limited solely to their internal budget. Likewise, interviewees commented that the funding helped to off-set lost market opportunities as they were able to bring a technology to market more quickly as a result of more resources available to complete a project. Comments from interviewees include:

"Funding helps offset R&D costs - more competitive internationally, because Company competes internationally, they must spend millions each year to stay competitive internationally… helps when government can offset that … don't just rely on government missions… compete with all the "Big guns" that have big funding from their governments…"

"Project would rely solely on internal financing, so STDP provides significant leverage because allows to significantly expand R&D budget."

Leveraged internally…, got funding from DND and Technology Partnerships Canada. All kinda contingent on each other; funding scenario had to be brought together at once. All were assuming that the other sources of funding would come in. If took out STDP funding, project would not have started. Overall project value was several times more than STDP.

To assess the impact that the STDP has had on employment within the Canadian space industry, a review of the ORIS database was undertaken. Employment information was available for 23 of 241 contracts. While information was limited, the analysis revealed that of the 23 contracts, an average of 3.64 jobs were created/contract. This average may actually under-represent the total employment generated from these contracts as the ORIS database reflects data provided at completion of project; the number may be higher as the technology evolves and markets are secured.



# of jobs created per contract were rounded to produce this graph

The consulting team also obtained details from interviews with industry representatives (interviewees) regarding the impact of STDP awarded contracts (e.g., number of jobs

created/retained, revenues generated from project, etc.). However, as noted in the limitations section at the front-end of the report, a key lesson that was learned by the consulting team when preparing the 'success stories' was that a significant amount of validation of figures was required. Interviewees, at times, had difficulty distinguishing between STDP contracts and other CSA funding. As such, the figures regarding impact of STDP funded contracts resulting from industry interviews could not be generalized, nor validated. Consequently, there was greater reliance on the information gleaned from ORIS and from the success stories when reporting on the overall impact of the STDP with regards to employment, R&D and spin-offs facts.

In terms of employment:

- For a first company, approximately half of employment may be directly attributed to the increase in capacity derived from STDP supported projects; approximately 50 jobs. This accounts for about half of their staff.
- For a second, STDP contracts were essential in maintaining its employees during the fiber optics crash. It is estimated that for every $100K/year invested by the STDP resulted, on average, in the maintenance or creation of 1 full-time position in the company.
- For a third, the STDP R&D funding provided indeterminate employment to approximately 20 people in the company. As well, the results from STDP R&D activities have provided commercial income for the company to maintain jobs during downsizing periods in the Canadian Space Industry.
- For a fourth, the technology developed through STDP contracts has provided the company with the required resources to hire/maintain 6 employees, about 6% of its workforce.
- A last company, has added approximately 500 employees since 2002, of which 100 relate to expanding product portfolio (and STDP involvement therein) and a further 100 minimum jobs maintained due to development work related to preserving key product market share.

In terms of revenues:

- For a first company, on an annual basis, approximately 15-20% of all company sales may be attributed to the technological advances that resulted from the STDP support. This amounts to $125M over a five year scale ($25M/year).
- For a second company, the technology developed has generated $1.8M in direct royalty revenue since its release in 2001. This includes $420K in 2008, which account for 8.3% of total royalty revenue. In addition, indirect revenues (services, reseller margin, training, etc.) have also generated high sources of revenue with an estimated additional $700K to date.
- For a third company, the current return on STDP investment is at the level of 100%; that means that overall STDP investment generates an equal commercial volume. In 2008 this segment was in the range of $25M. The company projects that by 2010, the multiplying factor will be in the range of 400%.
- The fourth company has noted that CSA/ESA funding amounted to less than $3M for the development/advancement of the technology; however, to date, the company has yielded

$30M in commercial exports which amounts to a 10-1 return on investment. The company has indicated that over the next five years, potential revenues of at least $40M are expected.

- For the last company, two of its key products, developed with assistance from the STPD, have generated total revenues to date of approximately $8 million. However, the projected potential revenues from both technologies are expected to be $15-$50 million over the next 3-5 years. According to the company, for every dollar that CSA provided through project funding, the company has been able to generate an $8 to $12 return. This demonstrates the significant role STDP funding has on the commercial success of the company.

STPD contracts have also led to spin-offs which have benefited the industry:

- For a first company, new markets are also opening as there is the potential of using the technology as a navigation system for helicopters operating in dusty or degraded environments, such as during military operations in Afghanistan. The technology provides vision to helicopter crews when their vision has been obscured by brownouts or whiteouts in order to avoid accident and allow for safe-landing.
- For a second company, STDP funding has assisted the company in developing and improving products, which has permitted the company to expand the business to other.
- For a third company, new capabilities developed from the technology have permitted greater access to markets in aerospace, automotive, consumer products, electronics, machinery and process industries. The customer base includes several companies in the aerospace sector. For example, the company is working to provide a sophisticated modeling of aircraft to understand the impact of temperature and radiation effects.
- For a last company, the technology created by STDP led directly to the creation of a new company.

Finding: *The STDP has contributed to reducing the risks involved with CSA missions (failures, time, resources) and made new missions possible.*

The advancement of TRL is an indicator of the CSA working towards the objective of reducing risks associated with CSA missions and/or enabling potential new missions (program elements including mission concepts, innovative technologies, technologies for future missions). In reviewing information available in the ORIS database, it was revealed that the majority (90.3%) of STDP funded contracts resulted in an advancement in R&D (reflected in TRL increases). TRL and financial information was available for 93 contracts between 2002 and 2007. Of those contracts, the majority (90.3%, n=84) saw a minimum TRL increase of 1. The advancement of technologies that are brought to a higher readiness level, for projects linked to reducing risks associated with Canadian space missions, is indicative that the program has contributed to the advancement of the Canadian Space Program.

Success stories and interviews also confirmed that STDP contracts have led to the advancement of technologies which have been brought to a higher readiness level. Many industry interviewees were also able to specify how STDP funded technologies reduced risks associated

with future space missions. For instance, the FEMAP TMG technology, produced by MAYA through STDP contracts, has contributed to the success of CSA missions on multiple occasions by providing partners with required technology to test models and technologies prior to flight to improve design and contribute to minimizing some mission risks. Neptec's TriDAR sensor can be incorporated during a mission's rendezvous, docking, undocking and fly-around operations. Using a 3D-sensor and thermal imager, TriDAR is able to track the International Space Station from the Shuttle Discovery, thereby acquiring the data needed to successfully mate the two vehicles. MBP successfully demonstrated a self-healing resin that can fill cracks caused after mechanical and accelerated thermal shocks had occurred. The successful results allowed the company to win the STDP contract to apply the self-healing technology for pioneering self-healing of damage caused by space debris. These are but a few of the examples provided by interviewees which identify how STDP funded technologies have reduced risks involved with CSA missions.

Not only have STDP funded projects advanced the technology readiness levels, but many projects have actually reached 'flight proven' stage', and therefore contributed to Canadian space missions and foreign missions. Examples include:

- A technolgy was successfully tested on the Space Shuttle mission (STS 128) in August, 2009. This technology is currently scheduled to be included on the STS 131 Space Shuttle mission. The company is also working with CSA and looking at other programs in Europe where this system could be used, for example the Mars Sample Return flight. The technology can also be used for potential satellite repair missions.
- Knowledge/products obtained as a result of the STDP contracts led to incorporation into /enabling of the following missions and programs:
    - First set of technologies: Program A (British Mission), Satcom BW2, Sicral (French Military), MUOS, Gen 1 TC, Direct TV
    - Second set of technologies: Terrastar, Globalstar & High Power Ku
    - Third set of technologies: Program A, Satcom BW2, WINDS, GS2
- A technology developped has been a vital engineering tool for many missions over the course of the last ten years, which includes RADARSAT and the future RCM mission. Goodrich has also applied the technology to the Hubble Telescope. The company is also using "Quick Sat", and integrating the technology into development of internal satellites for foreign payloads (Spanish). It is also undertaking an internal project for JC2-satellite for the Japanese Space Agency.
- And other company is anticipating that the technology developped will assist future space missions (CSA or others) as it offers a smaller, lighter technology than past options. Currently, the company is also pursuing a possible space-tech demo of the self-healing developed technology. The successful space-demo would lead to a number of pioneering systems and a new line of products.
- Finally, a technology has been used for a variety of missions including integration into an orbit Mobile Servicing System (MSS) astronaut training simulator delivered to the International Space Station (ISS), as well as for Advanced Thermal Environment (ATEN) ISS Payload. The technology has been incorporated into the "Quick Stat Satellite". It

will also be adapted to payloads on unmanned rovers for future moon and planetary exploration missions.

CONCLUSION:

The STDP has had a strong impact on the Canadian space industry. The majority of companies interviewed acknowledged the importance of the program to the space industry and to their own companies. All interviewees have acknowledged that the funding has assisted in the advancement of their space technology R&D. The success stories strongly emphasize the impact that the contracts have had, in terms of employment, revenues, business opportunities (both national and international), commercialization of their products, and other spin-offs. It is evident that the STDP contracts have contributed to growth in the space industry.

Although various contracts were issued solely for the purpose of strengthening the Canadian space industry, the technologies developed from these contracts have contributed to advancing the Canadian Space Program by reducing risks associated with future missions, and or enabling potential new missions. The success stories also highlight that technologies have been used by other international space agencies. The Canadian Space Program is tightly knit ecosystem which comprises government, industry and universities. An STDP investment in industry-driven technologies has positive, direct and indirect impacts on the fabric of the whole Canadian Space Program; as STDP funded technologies exist not only to respond to CSA's programs but also to the much wider international commercial or government-to-government markets.

4.4 Cost-Effectiveness/Alternatives

The findings of the evaluation of the STDP on the issue of program cost-effectiveness/alternatives are presented in this section of the report. The evaluation questions which were considered in addressing the issue of cost/effectiveness were as follows:

- Are there more cost-effective ways to achieve the same outcomes as the Program? / Is it more cost-effective for the CSA to conduct the research internally or have someone undertake it externally?
- How could the efficiency of the STDP program be improved
- ?

Finding: *Current structure of the STDP is cost-effective at contributing to meeting the needs of the Canadian Space Agency.*

The evaluation team was unable to establish the cost-effectiveness of the STDP and to compare it with similar delivery models. Given the scope and nature of the STDP's mandate, the consulting team was unable to collect information on comparable programs in other space agencies or organizations. International accounting practices vary greatly and Space Agencies are protective of their information, therefore the consulting team could not compare the CSA with other Space Agencies. Furthermore, as this is solely a federal jurisdiction, there are no provincial or territorial models with which it could be compared. The uniqueness of the space industry also made it difficult to compare this program to programs in other industries. This uniqueness ensures that the program does not duplicate or overlap with other federal or provincial programs.

Assessing the cost-effectiveness of CSA contracting-out space technology R&D was also a challenge. The nature of space industry and the associated space technologies—the vast spectrum of knowledge required-made it such that it was unrealistic for the CSA to entirely undertake its own R&D. It would be prohibitively too expensive for the CSA to undertake all of its own research in order to meet its needs. Consequently, commencing a comparison of the cost effectiveness of undertaking internal vs. external R&D was not considered as internal R&D at 100% was not an option for the Agency, or for any major space agency.

One element that can be considered in assessing the cost-effectiveness of the STDP is to consider the total R&D funds that are leveraged to undertake STDP contracts. As noted earlier, there were five program areas that were targeted by the program during the review period: mission concepts, innovative technologies, technologies for future missions, industrial capabilities, and in-orbit technology demonstration. The co-funding requirement varied depending on the program element that was being targeted. For instance, CSA would not require co-funding for high risk projects (e.g., mission concepts) yet require co-funding, for example of 30%, for technologies related to industrial competitiveness. Therefore of the total value of STDP contracts targeted towards the development of technologies related to industrial competitiveness issued during the evaluation period ($65.54M), companies with the Canadian Space Industry contributed/co-funded approximately $26.57M. Consequently, it can be argued that the CSA budget for industrial competitiveness was augmented by 40% as a result of the co-funding provided by industry. A larger pot of funds was available for furthering the development of space technologies. The program has effectively augmented the budget for R&D in space technologies for both CSA and companies participating in the program. Fundamentally, depending on industry investment requirements identified in STDP contracts, both the CSA and industry are benefitting by collaborating on space technology R&D. Various companies had noted that they were able to undertake more R&D as their internal budget was augmented after obtaining a STDP contract. As noted earlier in the report, industry respondents had indicated that STDP provided their companies with financial leveraging opportunities. Interviewees noted that companies could undertake more R&D, as they are not limited solely to their internal budget. Likewise, interviewees commented that the funding helped to off-set lost market opportunities as they were able to bring a technology to market more quickly as a result of more resources available to complete a project.

In terms of the overall efficiency of the STDP program, a few suggestions that have been noted throughout the report include:

- streamlining the RFP submission process by automating various aspects, including the submission of reports electronically;
- ensuring the timely issuance of contracts to prevent technologies from becoming less strategic due to delays;
- sharing of final contract reports/results within the CSA through the establishment of a formal communication strategy to ensure proper knowledge transfer; and
- ensuring that an Agency approved ever-greening Technology Plan provides sufficient guidance to the STDP regarding future missions, the technology required for those missions, the prioritization of the technologies for each mission, the time required to

complete the R&D, the level of TRL for each technology, cost analysis, technology requestor, etc.

CONCLUSION:
It is unrealistic for the CSA to entirely undertake its own R&D; consequently the current structure of contracting-out work is effective at meeting the needs of the Agency. In addition, the program is cost-effective from an R&D perspective as both the Agency and industry (depending on industry investment requirements identified in STDP contracts) are investing in the development of space technologies that may have a positive impact on meeting the future needs of the Canadian Space Program, thus augmenting the total R&D budget.

5. Recommendations

This section of the report provides recommendations for the Program based on the findings and conclusions reported.

RECOMMENDATION:

Greater clarity regarding the objectives of this contracting program is needed.

The STDP program has a logic model which identifies two distinct objectives. The focus of the program/contracts, during the period under review, was on achieving the objective of strengthening the Canadian space industry. However, as the STDP is primarily a contracting program which should issue contracts in response to CSA's own identified needs and opportunities, the primary objective should be that of reducing risks associated with CSA missions. The recent establishment of a G&C Program will enable the CSA to provide financial support to organizations to conduct space-related research and development in priority areas. STDP will now have the authority to issue contributions to industry, specifically as it pertains to the development of space technologies that may not be directly linked to a CSA need as identified in the Agency's Technology Plan. The Research component of the G&C program should ensure that companies in the Canadian space industry, that relied on the STDP for R&D funding to further technological advancement even though it did not directly meet a CSA need, will have access to funds.

Both mechanisms, contracts and contributions, will enable the program to achieve its two main objectives. Greater clarity regarding which mechanism to implement to achieve program objectives should be communicated within the STDP, and the broader CSA and Canadian space industry.

RECOMMENDATION:

CSA needs to clearly map all proposed missions and related R&D technology requirements.

In FY 2009/10 the Space Technology Branch actively began the development of a Technology Plan. To ensure that this plan provides more guidance to the STDP than previous versions that were shelved, it will need to clearly identify: future missions, the technology required for those missions, the prioritization of the technologies for each mission, the time required to complete the R&D, the level of TRL for each technology, cost analysis, technology requestor, etc. This is a contract-out program. It should exist to meet the needs/opportunities of the CSA. However, input from industry and other key stakeholders should be sought. For instance, industry is working with other space agencies and may be positioned to know what technologies are being considered. Consequently, the Technology Plan needs to be all inclusive/wide-ranging with input from academia, industry, other space agencies for co-operative missions, CSA staff, and

other key departments. However, all priority technologies should be assessed in relation to meeting the needs of the CSA. The plan should be regularly updated to ensure its relevance.

RECOMMENDATION:

STDP personnel and PWGSC need to clearly map the procurement and contracting process, roles of each party, service standards, and their requirements

Delays (RFP and contract issuance) are costly to both CSA and to industry as time sensitive R&D is being delayed. Few interviewees had positive comments regarding the efficacy of the procurement and contracting processes. The CSA has recently established a joint working group between the Agency and PWGSC. While the working group is looking at more than just the STDP, it is recommended that the group clearly establish better processes and service standards between CSA and PWGSC to ensure that the process becomes more efficient. Delays of over a year to award a contract is excessive.

RECOMMENDATION:

Further study on the possibility of introducing a two-step application process: 1) letter of interest detailing the technology and 2) complete proposal if requested

Some of the smaller space industry companies had noted that they would not bid for contracts given the overall cost for them to participate versus the overall contract size. To ensure greater participation by industry, the STDP should consider whether a two-step application process is viable. Companies can put forward a letter of interest, and if STDP considers the R&D to be of value, than the company can be asked to submit a formal detailed proposal. Review of other R&D programs that conduct a two-step application process should be examined.

RECOMMENDATION:

CSA needs to improve communications with industry and stakeholders through announcements or workshops, ahead of the release of its RFPs.

While STDP personnel have provided assistance to companies bidding on contracts, more formalized documents should be prepared. The infrequency of RFP issuance may present challenges to smaller companies less familiar with the process of responding to contracts. There is significant amount of technical work that is required to respond to an RFP. There is also significant amount of Government processing requirements that need to be met and a company not familiar with this process may be disqualified as a result of their lack of familiarity. It is recommended that various tools be developed that may be of assistance to companies less familiar to the STDP. For instance, a complete sample proposal that clearly shows the amount of effort/detail required.

RECOMMENDATION:

A formal communication strategy for communication of project results to interested CSA parties

Final STDP funded contract reports would typically remain with the STDP. The failure to communicate project findings within the CSA is mainly due to the fact that there was never a technology requestor identified as being interested in final R&D project results. The Technology Plan currently being developed by the Space Technology Branch does require that a technology requestor be identified. This information should facilitate the STDP transferring knowledge generated from the program throughout the CSA.

Appendix A – Evaluation Matrix

EVALUATION ISSUES / QUESTIONS	PERFORMANCE INDICATORS	MEASURES	DATA SOURCES
RELEVANCE			
1. Does the program area or activity continue to serve the public interest? (ERCQ1 - Public Interest)	1.1. Extent to which the program is achieving its mandate and objectives (Strategic review question 4)	Extent to which STDP contributes strategically to the commercial viability of the Canadian Space industry	Answers of indicators question S.2 and S.3 Interview with Space Tech DG Annual survey from space industry
		Extent to which STDP contributes strategically to decrease risks associated to the development of Canadian missions	Answers of indicators question S.3 Interview with the DGs (Space Tech, Spaced Science, Space Programs, and Sciences & Operations) [3] Interview with DG from three stakeholder departments
	1.2. Extent to which the program addresses a demonstrable need (Strategic review question 1)	Extent to which a coordinated approach to the management of technological R&D contracts within the CSA (single window) is required	Interviews with the DGs Interviews with the CSA's Technology, Sciences and Operations directors, as well as Space Program List of Space missions from the DPR Telephone interviews with the companies: C3, +2 Telephone interviews with 30% of C6 companies and + Roadmaps
		Relevance of the CSA supporting the development of space technologies	
		Stakeholders' level of satisfaction with respect to the coherence and transparency of the whole process: - selection of priority technologies; and - selection of the projects and the required follow-up.	
	1.3. Extent to which the program linked to a Government priority (Strategic review question 2)	Degree of alignment of Program outcomes with CSA mandate	Canadian Space Agency Act CSA (s. 4-5), STDP Management framework, Logic Model,

[3] Please note that “Interviews with DGs” will always refer to the DGs from these 4 groups, unless otherwise stated.

EVALUATION ISSUES / QUESTIONS	PERFORMANCE INDICATORS	MEASURES	DATA SOURCES
			CSA PAA Interview with Space Tech DG Interview with the President of the Agency
		Degree of alignment of Program outcomes with current GoC priorities	Speech from the Throne (from the period being evaluated), Industry Canada R&D Policy and other relevant documents Interview with Industry Canada
	1.4 Stakeholders required STDP support to achieve their respective objectives	Extent to which projects which would not have been undertaken without STDP funding	Case studies Interviews with companies Information in companies' proposals
SUCCESS			
2. How has the STDP positively contributed to the development of the economic viability of the Canadian space industry? [4]	2.1 New capabilities developed through STDP contracts were instrumental to access new business opportunities nationally, abroad, to develop new business alliances or to strengthen existing business alliances [5] [6]	Number of new markets accessible to companies through the contribution of STDP contracts	Interviews with the companies: C3, +2 Interviews with 30% of C6 companies and + with C20 companies Case Studies (TBD) Evaluation grid and the rating guide for proposals Document about the definition of Canadian content
		Examples where STDP contracts have contributed to the participation of a Canadian company into a space mission in Canada or abroad	
		Examples of Canadian technology used in foreign space missions	
	2.2. Employment resulting directly from the completion of an STDP R&D project	# of jobs created or retained during the project and kept after the project	Sid's report on company financial ORIS (Statistics requested at the end of projects Interviews with the companies
	2.3. Revenue (product or services sold, etc.) produced because of the capacity or	Financial data from companies (the use of real examples and numbers should be considered to prove	Company presentations to the president – C10. Interviews with the companies

[4] Need to consider that some companies do not come to the CSA at all, some companies are viable because of other branches of their business.
[5] Also have to see if the STDP/CSA in fact, keeps some of these businesses "alive", i.e. that they would not be in business if the STDP did not exist.
[6] It must also be noted that the STDP funds the greater risk R&D projects. Those very low risk projects are completed by the business sector without the involvement of the STDP.

EVALUATION ISSUES / QUESTIONS	PERFORMANCE INDICATORS	MEASURES	DATA SOURCES
	the technology developed by STDP	the assumption)	
	2.4. STDP R&D results are used by industry to carry out future product development	Evidence that companies have found other applications for the technologies supported by STDP	Interviews with companies Documented evidence of use of the STDP R&D results
3. How has the STDP contributed to reducing the risks involved with CSA missions (failures, time, resources) and/or made new missions possible? [7]	3.1 Extent to which the CSA's strategy to develop new space technologies serves Canadian missions as well as foreign missions where the CSA participates	Statistical information on TRL increases as well as the number of contracts and the value of the contracts	Interview with staff Total Contract List Matrix Focus group ORIS stats on TRL (initial, target, reached)
		How has the CSA used the technologies developed/materialized through the STDP R&D contracts	Interviews with CSA staff Documents demonstrating the use of the technologies in CSA Future mission projects.
		List of technologies developed thanks to the STDP procurement processes and which are in use in Canadian space missions	Project reports or other documents identifying/listing the technologies. Interviews with mission sponsors
		Examples of technologies which have become "space qualified" and how many have gone into space	ORIS – « ready to fly » technologies : TRL-6 Interviews with companies
		Examples of cost savings (value) generated from the use of STDP R&D results (technology and knowledge) in CSA-led missions	Interviews with companies from C3, C10 and S20 Interviews with CSA staff from Space Programs
		Missions made possible thanks to the new knowledge or technologies supported by the STDP (failures, time and resources)	Interviews with CSA staff Documents demonstrating the use of the technologies in CSA Future mission projects.
		Examples of how the technologies reduced the risks of CSA missions (failures, time and resources)	Interviews with CSA staff Documents demonstrating how STDP funded technologies reduced the risk of missions

[7] List of Canadian Missions and their sponsors may be provided CSA led missions: Cassiope, Chinook, Hero (hyperspectral)/ Quicksat: Proba and Sentinel (ESA missions) / Dynacon – FedSat, TechSat

EVALUATION ISSUES / QUESTIONS	PERFORMANCE INDICATORS	MEASURES	DATA SOURCES
4. To what extent has the Canadian space industry increased its capacity over the years thanks to the technology development contracts granted by the STDP?	4.1. Commercial products which depend, in part, on the knowledge, tools or capacity acquired through the STDP and/or the technologies supported by the STDP which are integrated in a commercial product	Examples	Interviews with category 1, 2 and 3 companies Annual survey from space industry. Case studies Company presentations -
	4.2. Examples where STDP contracts have enhanced the technological and innovation capabilities of Canadian companies	Examples	Interviews with category 1, 2 and 3 companies Results from CSA questionnaire
	4.3. Skills or technologies acquired as a result of a STDP contract and the extent to which the STDP contracts are used to enhance companies' technology base	Examples where because of STDP contracts, Canadian firms have developed or demonstrated advanced technologies systems, components or studies	Interviews with companies Project reports Other key documents
5. To what extent has the CSA increased its capacity over the years thanks to the technology required for the development and planning of new or current space missions thanks to the STDP?	5.1. Critical role of the knowledge, products and service obtained as a result of the R&D contracts managed by the STDP with respect to the development and planning of new or current space missions	% of contracts that allowed a TRL to advance	ORIS stats on TRL (initial, target, reached) Interviews with companies
		examples of contracts that allowed new space missions examples of contracts that allowed current/existing missions	Interviews with CSA staff Interviews with companies Reports and key documents demonstrating use of STDP knowledge, products and services Case studies
6. Has the STDP	6.1 Unintended consequences or	Examples or evidence that STDP is achieving	Interviews with CSA staff

EVALUATION ISSUES / QUESTIONS	PERFORMANCE INDICATORS	MEASURES	DATA SOURCES
generated any unintended impacts, results or benefits?	unforeseen side effects due to the STDP	unexpected or unwanted results for: CSA, companies, other stakeholders	Interviews with companies Year end reports/ project reports or other relevant documents
DESIGN AND DELIVERY			
7. Do the STDP's design and delivery allow the program to effectively achieve the program's objectives?	7.1. Extent to which the organization has the capacity to effectively spend and manage for results and to deliver on its core mandate (Strategic review question 6)	Evidence that the tools in place (RFP, selection criteria, management of priorities, management framework), meet the needs of the STDP	review of documents documenting protocols, policies and/or procedures Interviews with STDP staff Interviews with CSA staff Interviews with companies
		Contract administration adheres to Government Contracting Regulations	
		Canadian companies have access to STDP contracts / commercial opportunities	
		RFPs and SoWs reflect the objectives set out in the priority-setting process	
		Contracts reflect the objectives set out in the RFPs and SoWs	
		The results of STD R&D projects reflect the objectives set out in the contracts	
	7.2 Steps taken over time to improve the contracting process	Evolution of statements of work, evidence requested to support the proposals	Review of RFPs and comparison of their content Interviews with STDP staff preparing RFPs and involved in the contracting process
		Evidence of other steps taken to improve the contracting process	
	7.3 Issues addressed in previous audits,	Evidence of work being done or completed to	Interviews with STDP staff

EVALUATION ISSUES / QUESTIONS	PERFORMANCE INDICATORS	MEASURES	DATA SOURCES
	reviews and evaluations have been addressed	addressed issues identified in the past	Comparison of past audits, reviews and evaluations with management responses and other key documents Perhaps interview with Director of Audit and Evaluation
COST-EFFECTIVENESS / ALTERNATIVES			
8. Are there more cost-effective ways to achieve the same outcomes as the Program? / Is it more cost-effective for the CSA to conduct the research internally or have someone undertake it externally?	8.1. Extent to which the program is achieving its expected results efficiently (Strategic review question 5)	Comparison of STD costs with value of managed contracts	Review of financial reports and information
	8.2 Cost sharing provides a leveraging effect, which results in more efficient resource utilization and decreased risk for the Canadian space sector	Co-funding	ORIS for original comparison between gov. and company investments in the projects.
		Evidence/opinions of presence of leveraging and risk reduction effects of STDP contracts	Interviews with companies Project reports Other key documents.
	8.3 Econometric analysis of STDP impacts	To be determined based on applicability of existing models used by Industry Canada	Financial information and information from CSA documents Draft econometric study on a some Space Industry companies
	8.4 Return on Objectives (ROO) of STDP impacts	Comparative analysis of management costs versus total budget	Financial information and information from CSA documents Comparison with other federal R&D programs and organisations Comparison with other comparable programs or agencies such as NASA and the European Union (dependent upon document availability)
		Average cost for technology “maturation” - ORIS	
9. How could the efficiency of the STDP program be improved? (ERCQ6 - Efficiency)	9.1. Ways of improving the returns for the CSA for the same amount or less	Stakeholder opinions obtained through interviews and focus groups	Interviews with companies Interviews with CSA Interviews with STDP staff Focus group
	9.2. Impact on the Canadian Space industry and the Canadian Space missions	Stakeholder opinions obtained through interviews and focus groups	Interviews Focus group

EVALUATION ISSUES / QUESTIONS	PERFORMANCE INDICATORS	MEASURES	DATA SOURCES
	if the STDP was cancelled	Evidence of a requirement for CSA to manage and coordinate the process (Do we need this one?)	Interviews Focus group Evidence found in CSA documents

Appendix B – List of Documents Reviewed

Guidance on Contracting

1. Contracting Policy, Treasury Board of Canada, Secretariat (2006).
2. Procurement Review Policy, Treasury Board of Canada, Secretariat (1994).
3. Policy on Title to Intellectual Property Arising Under Crown Procurement Contracts, Treasury Board of Canada, Secretariat (2000).

Guidance on Grants and Contributions

4. Policy on Transfer Payments, Treasury Board of Canada, Secretariat (2000).
5. Guide on Grants, Contributions and Other Transfer Payments, Treasury Board of Canada, Secretariat (2002).
6. From Red Tape to Clear Results: The Report of the Independent Blue Ribbon Panel on Grant and Contribution Program, Government of Canada (2006).

Policy Drivers for CSA

7. Canadian Space Agency Act, 1990, c. 13, Department of Justice (1990).
8. The Canadian Space Strategy: Serving and Inspiring the Nation, Canadian Space Agency (2003).
9. National Aerospace and Defence Strategic Framework: 2005-2025, Industry Canada (2005).
10. The Global Exploration Strategy: the Framework for Coordination, ASI, BNSC, CNES, CNSA, CSA, CSIRO, DLR, ESA, ISRO, JAXA, KARI, NASA, NSAU, Roscosmos (2007).
11. Canada's New Government: Mobilizing Science and Technology to Canada's Advantage, Government of Canada (2007).
12. Speaking Points, The Honourable Jim Prentice, PC, QC, MP, Minister of Industry, Canadian Space Agency, St. Hubert, Quebec (April 11, 2008).
13. Speaking Points, The Honourable Jim Prentice, PC, QC, MP, Minister of Industry, Announcement of NSERC's Research Grants and Scholarships, Victoria, British Columbia (May 21; 2008).
14. Speaking Points, The Honourable Jim Prentice, PC, QC, MP, Minister of Industry, Canadian Space Agency Address, Saint-Hubert, Quebec (May 9, 2008).
15. Speaking Points, The Honourable Jim Prentice, PC, QC, MP, Minister of Industry, Canadian Space Agency, Canadian Astronaut Recruitment Campaign Announcement, Longueuil, Quebec (March 31, 2008).

CSA Corporate Reports

16. Report on Plans and Priorities (RPP), Canadian Space Agency (2004/2005 – 2008/2009).

17. Departmental Performance Report (DPR), Canadian Space Agency (2003/2004 – 2007/2008).
18. Management Accountability Framework (MAF) Assessment 05/06, Canadian Space Agency (2006).
19. Management Accountability Framework (MAF) Assessment 05/06, Treasury Board of Canada, Secretariat (2006).
20. Modern Comptrollership Evaluation, Canadian Space Agency, Audit and Evaluation Directorate (2003).
21. Report of the Auditor General of Canada to the House of Commons: Chapter 7: Canadian Space Agency – Implementing the Canadian Space Program, Office of the Auditor General Of Canada (2002).
22. Canadian Space Agency – 2008-2009 Program Activity Architecture (PAA) (*Approved by Treasury Board Secretariat),* 2007
23. Canadian Space Agency – 2009-2010 Program Activity Architecture (PAA), 2008
24. Cadre de gestion de la Direction générale, Technologies spatiales - suivi du Plan d'action de la gestion au 31 décembre 2007 Concernant le projet de vérification, 2007
25. Generic Technological Activities Logic Model, 2008
26. Audit Report – Management Framework of the Space Technologies Branch, Canadian Space Agency, 2005

Program-Specific Documentation

27. Space Technologies Branch, Management Framework, Canadian Space Agency, 2008.
28. Space Technologies Branch Logic Model, Canadian Space Agency, date unknown.
29. Technology Development Group, Year-End Report 2007-2008, Canadian Space Agency, 2008.
30. Space Technology Development Program, Management Framework Rev. 1-5, Canadian Space Agency, 2008.
31. Space Technologies Development Program STDP (deck), Canadian Space Agency, 2008.
32. Performance Measurement Framework, Space Technology Development Program (STDP), Draft 3, Canadian Space Agency, date unknown.
33. STDP Risk Management Framework, Canadian Space Agency, date unknown.
34. Canadian Space Agency Business Plan 1998-1999 to 2000-2001, Canadian Space Agency, 1998.
35. .
36. Planning, Reporting and Accountability Structure, Canadian Space Agency, 1999.
37. 2002 Space Technologies Development Program Request for Proposals, Canadian Space Agency, 2001.

38. 2003 Space Technologies Development Program Request for Proposals, Canadian Space Agency, 2003.

39. 2004 Space Technologies Development Program Request for Proposals, Canadian Space Agency, 2003.

40. 2004 Space Technologies Development Program Request for Proposals - Special Issue: Technologies for the Enhancement of Industrial Capabilities in the SatCom / GNSS Sector, Canadian Space Agency, 2003.

41. 2005 Space Technologies Development Program Request for Proposals - Technologies for the enhancement of industrial capabilities, Canadian Space Agency, 2005.

42. 2005 Space Technologies Development Program Request for Proposals – Innovative technologies and technologies for future Canadian space missions, Canadian Space Agency, 2005.

43. Space Technologies Development Program: Standard Operations Manual – Competitive Procurement Process, Canadian Space Agency, date unknown.

44. 55. Summary of STDP financial information 2002 to 2006, Canadian Space Agency, date unknown.

45. 56. 2006 Space Technologies Development Program Request for Proposal - Program Element: Technologies for the Enhancement of Industrial Capabilities, Canadian Space Agency, 2006.

46. 2006 Space Technologies Development Program Request for Proposal - Program Element: Innovative technologies and technologies for future Canadian space missions, Canadian Space Agency, 2006.

47. Technology Development Group Year end report 2007-2008, Canadian Space Agency, date unknown.

48. Technology Priorities for Space Technology Development Program 2008-2009 – Technology Requirements and planning, Canadian Space Agency, 2008.

49. Typical Contract, Canadian Space Agency, date unknown.

Other CSA Documentation

50. The Canadian Space Strategy, 2003, PDF.

51. Canadian Space Agency, The Space Technologies Development Program, stdp_MEC.pdf.

52. Canadian Space Agency, Space Technologies: Investing in our Future, Document.

53. Canadian Space Agency Directorate of Technology Management and Applications, Financial Analysis, MDA, Draft Report, 2006, Protected B.

54. Canadian Space Agency Directorate of Technology Management and Applications, Financial Analysis, COM DEV, Draft Report, 2007, Protected B.

55. Financial Analyses, Directorate of Technology Management and Application, Canadian Space Agency, 2007, PDF.

56. Economics of CSA Investments (Historical Data), 2007.
57. Canadian Space Agency, Bringing Space Technology to Canadians, PDF, 2003.

Documentation on industrial benefits.

Company Websites

58. MDA Corporation: http://www.mdacorporation.com/corporate/index.cfm
59. MPB Communications: http://www.mpbc.ca/index.html
60. MAYA HTT : http://www.mayahtt.com/
61. COM DEV: http://www.comdev.ca/
62. Neptec Design Group: http://www.neptec.com/Index.html
63. Xiphos: http://www.xiphos.ca/
64. Xiplink : http://www.xiplink.com/

Appendix C – Interview Guides

Evaluation of the Space Technologies Development Program

Interview Guide – STDP Team (including former STDP managers)

Introduction

The Canadian Space Agency (CSA) has asked Government Consulting Services (GCS) to conduct the evaluation of the Space Technologies Development Program (STDP). This evaluation will help to inform future decisions related to the program.

As part of the evaluation, GCS is conducting interviews with CSA employees from different branches involved in the program. The purpose of these interviews is to obtain informed perspectives on the program's relevance, success, and cost-effectiveness/alternatives.

The following questions will serve as a guide for our interview. In some cases, questions may not be relevant to your particular situation or experience. The interview will focus on those questions most relevant to you.

Please also note that the responses you provide are confidential and will not be attributed to you in the evaluation report (only aggregate information will be released) or in any documentation provided to the CSA.

INTERVIEW QUESTIONS

Background

1. What is your role within the STDP and how long have you been in this position as well as working for the CSA?

Relevance

2. What role should the CSA play in the development of space technologies? (1.2) - NEW
   - *Supporting R&D contracts and projects from outside the CSA?*
   - *Undertaking R&D projects internally?*
   - *Other?*
3. Do the STDP outcomes align with the CSA's mandate? (1.3) - NEW
   - With respect to the Canadian space industry:
     - *Increase technological capacity of the Canadian space industry in strategic areas;*
     - *Maintaining/improving the economic viability of the Canadian space industry.*
   - With respect to the CSA:
     - *Increased knowledge for planning and development of existing and future space missions;*
     - *Reduced risks associated with missions and/or enabling new missions;*
   - With respect to the socioeconomic benefits for Canadians stemming from the research and development in space technologies?
4. Is there a need for a coordinated approach to R&D contracts within the CSA? Please explain why this is or is not required. (1.2) - NEW

Results

5. Using the following scale, where 1 is *no strategic contribution* and 5 is *significant strategic contribution*, to what extent would you view the STDP as contributing strategically to the commercial viability of the Canadian Space Industry and to your organization? Please explain (1.1) - NEW

No strategic contribution		**Some strategic contribution**		**Significant strategic contribution**	**N/A**	**DK**
1	2	3	4	5	8	9

7. Using the following scale, how would you characterize the extent to which the STDP has contributed strategically to decreasing the risks associated to the development of Canadian space missions? Please explain. (1.1) – NEW

No strategic contribution		Some strategic contribution		Significant strategic contribution	N/A	DK
1	2	3	4	5	8	9

7. How have the technologies and knowledge developed through STDP contracts been used by the CSA? Please provide examples when applicable. (3.1)
   - *missions made possible;*
   - *missions made easier to carry through;*
   - *risks reduced or eliminated;*
   - *statistical information on TRL increases; and*
   - *information on number of contracts and value of contracts awarded through STDP.*
8. Does the STDP play a critical role in the CSA's acquisition of knowledge, products and services required to develop and plan space missions? Please explain. (5.1)
9. Has the STDP generated any unintended impacts, results or benefits for your group, for other directorates, for the agency, for companies and/or other stakeholders? Please provide examples and explain if these were positive or not. (6.1)

STDP Processes and Cost-Effectiveness

10. Using the following rating scale, how would you characterize the following with respect to the coherence of the STDP process: (1.2) - NEW

		Not At All Coherent		Somewhat Coherent		Very Coherent	N/A	DK
a)	Selection of priority technologies?	1	2	3	4	5	8	9
b)	Selection of the projects and the required follow-up?	1	2	3	4	5	8	9
c)	Of the process as a whole?	1	2	3	4	5	8	9

11. In your experience, is the STDP functioning efficiently with respect to its processes and procedures? What should be highlighted as functioning well and what could be improved? (7.1)
   - *RFP process, selection criteria, management framework*
   - *Adherence to Government Contracting Regulations*
   - *Companies access to STDP contracts and commercial opportunities*
   - *Contracts reflect the SOW and RFPs*
   - *Results of the R&D projects reflect the objectives of the contracts*
   - *Other areas?*

12. What steps have been taken to improve the STDP's contracting process? Have these been implemented? (7.2)
13. Previous audits identified some issues with respect to the STDP and/or the Space Technologies Branch. What steps have been taken to address the following as they apply to the STDP: (7.3)
    a) Ensuring that the administrative mechanisms are consistent with the nature of operations;
    b) Ensuring that staff are familiar with the Policy on Transfer Payments;
    c) Deliverables are received before issuing payments;
    d) Contracts cannot be interpreted as establishing and employer/employee relationship;
    e) Contract elements/processes such as price certifications and contractual agreements reflecting the obligations of both parties are included in all STDP contracts.
14. In what ways could the STDP be improved to maintain or improve the current returns for the same amount of funding or less? (*value for money)* (9.1)
15. What would be the impacts on both the CSA's Canadian Space missions and the Canadian Space industry if the STDP was cancelled? (9.2)
16. Are there any other items with respect to the STDP that you would wish to discuss with our team?

Thank you for your assistance in this important evaluation.

Evaluation of the Space Technologies Development Program

Interview Guide – CSA (excluding STDP personnel) and other departments

Introduction

The Canadian Space Agency (CSA) has asked Government Consulting Services (GCS) to conduct the evaluation of the Space Technologies Development Program (STDP). This evaluation will help to inform future decisions related to the program.

As part of the evaluation, GCS is conducting interviews with CSA management and other departments involved with the STDP program. The purpose of these interviews is to obtain informed perspectives on the program's relevance, success, and cost-effectiveness/ alternatives.

The following questions will serve as a guide for our interview. In some cases, questions may not be relevant to your particular situation or experience. The interview will focus on those questions most relevant to you.

Please also note that the responses you provide are confidential and will not be attributed to you in the evaluation report (only aggregate information will be released) or in any documentation provided to the CSA.

INTERVIEW QUESTIONS

Background

A. What is your role at the CSA/in your department and how long have you been in this position as well as working for the CSA/department?

B. What is the role/linkage between the STDP and your branch/department?

Relevance

1. What role should the CSA play in the development of space technologies?
   - *Supporting R&D contracts and projects from outside the CSA?*
   - *Undertaking R&D projects internally?*
   - *Other?*
2. Do the STDP outcomes align with the CSA's mandate?
   - With respect to the Canadian space industry:
     - *Increase technological capacity of the Canadian space industry in strategic areas;*
     - *Maintaining/improving the economic viability of the Canadian space industry.*
   - With respect to the CSA:
     - *Increased knowledge for planning and development of existing and future space missions;*
     - *Reduced risks associated with missions and/or enabling new missions;*
   - With respect to the socioeconomic benefits for Canadians stemming from the research and development in space technologies?
3. Is there a need for a coordinated approach to R&D contracts within the CSA? Please explain why this is or is not required.

Results

4. Using the following scale, where 1 is *no strategic contribution* and 5 is *significant strategic contribution*, to what extent would you view the STDP as contributing strategically to the commercial viability of the Canadian Space Industry? Please explain.

No strategic contribution		**Some strategic contribution**		**Significant strategic contribution**	**N/A**	**DK**
1	2	3	4	5	8	9

5. Using the following scale, how would you characterize the extent to which the STDP has contributed strategically to decreasing the risks associated to the development of Canadian space missions? Please explain.

No strategic contribution		Some strategic contribution		Significant strategic contribution	N/A	DK
1	2	3	4	5	8	9

6. How have the technologies and knowledge developed through STDP contracts been used by the CSA? Please provide examples of technologies and situations/missions when applicable.
   - *missions made possible;*
   - *missions made easier to carry through;*
   - *risks reduced or eliminated.*
7. Does the STDP play a critical role in the CSA's acquisition of knowledge, products and services required to develop and plan space missions? Please explain.
8. Has the STDP generated any unintended impacts, results or benefits for your directorate, for the agency, for companies and/or other stakeholders? Please provide examples and explain if these were positive or not.

STDP Processes and Cost-Effectiveness

9. Using the following rating scale, how would you characterize the following with respect to the coherence of the STDP process:

	Not At All Coherent		Somewhat Coherent		Very Coherent	N/A	DK
a) Selection of priority technologies?	1	2	3	4	5	8	9
b) Selection of the projects and the required follow-up?	1	2	3	4	5	8	9
c) Of the process as a whole?	1	2	3	4	5	8	9

10. In your experience, is the STDP functioning efficiently with respect to its processes and procedures? What should be highlighted as functioning well and what could be improved?
    - *RFP process, selection criteria, management framework*
    - *Adherence to Government Contracting Regulations*
    - *Canadian companies have access to STDP contracts and commercial opportunities*
    - *Contracts reflect the SOW and RFPs*
    - *Results of the R&D projects reflect the objectives of the contracts*
    - *Other areas?*
11. In what ways could the STDP be improved to maintain or improve the current returns for the same amount of funding or less? (*value for money)*
12. What would be the impacts on both the CSA's Canadian Space missions and the Canadian Space industry if the STDP was cancelled?
13. Are there any other items with respect to the STDP that you would wish to discuss with our team?

Thank you for your assistance in this important evaluation.

Evaluation of the Space Technologies Development Program

Interview Guide

Introduction

The Canadian Space Agency (CSA) has asked Government Consulting Services (GCS) to conduct the evaluation of the Space Technologies Development Program (STDP). This evaluation will help to inform future decisions related to the program.

As part of the evaluation, GCS is conducting interviews with CSA management and other departments involved with the STDP program. The purpose of these interviews is to obtain informed perspectives on the program's relevance, success, and cost-effectiveness/ alternatives.

The following questions will serve as a guide for our interview. In some cases, questions may not be relevant to your particular situation or experience. The interview will focus on those questions most relevant to you.

Please also note that the responses you provide are confidential and will not be attributed to you in the evaluation report (only aggregate information will be released) or in any documentation provided to the CSA.

INTERVIEW QUESTIONS

1. What is the role/linkage between the STDP and your branch?
2. Do the STDP outcomes align with the CSA's mandate?
   - **With respect to the Canadian space industry**:
     - *Increase technological capacity of the Canadian space industry in strategic areas;*
     - *Maintaining/improving the economic viability of the Canadian space industry.*
   - **With respect to the CSA**:
     - *Increased knowledge for planning and development of existing and future space missions;*
     - *Reduced risks associated with missions and/or enabling new missions.*
   - With respect to the **socioeconomic benefits for Canadians** stemming from the research and development in space technologies?
3. Is the current mandate/role of the STDP program appropriate or should it be changed?
4. How do you see the STDP linking with the long-term strategic plans of the agency?
5. Is there a need for a coordinated approach to space technologies R&D contracts within the CSA? Please explain why this is or is not required.
6. What would be the impacts on both the CSA's Canadian Space missions and the Canadian Space industry if the STDP was cancelled?
7. Are there any other items with respect to the STDP that you would wish to discuss with our team?

Thank you for your assistance in this evaluation.

Evaluation of the Space Technologies Development Program

Interview Guide – Canadian Space Industry Organisations

Introduction

The Canadian Space Agency (CSA) has asked Government Consulting Services (GCS) to conduct the evaluation of the Space Technologies Development Program (STDP). This evaluation will help to inform future decisions related to the program.

As part of the evaluation, GCS is conducting interviews with representatives from Canadian Space Industry Organisations. The purpose of these interviews is to obtain informed perspectives on the program's relevance, success, and cost-effectiveness/alternatives.

The following questions will serve as a guide for our interview. In some cases, questions may not be relevant to your particular situation or experience. The interview will focus on those questions most relevant to you.

Please also note that the responses you provide are confidential and will not be attributed to you in the evaluation report (only aggregate information will be released) or in any documentation provided to the CSA.

INTERVIEW QUESTIONS

A. What is your role within your organisation and how long have you been in this position?

B. Could you briefly describe the linkages between your organization and the STDP? What projects have been funded through the STDP?

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1. What role should the CSA play in the development of space technologies?

   Probe:

   - *Supporting R&D contracts and projects from outside the CSA?*
   - *Undertaking R&D projects internally?*
   - *Other?*

2. Using the following scale, where 1 is *no strategic contribution* and 5 is *significant strategic contribution*, to what extent would you view the STDP as contributing strategically to the commercial viability of the Canadian Space Industry and to your organization? Please explain.

	No Strategic Contribution		**Some Strategic Contribution**		**Significant Strategic Contribution**	**N/A**	**DK**
a) Canadian Space Industry	1	2	3	4	5	8	9
b) Your organization	1	2	3	4	5	8	9

3. Using the following scale, where 1 is *not at all instrumental* and 5 is *very instrumental*, how would you characterize the extent to which the STDP contracts were instrumental for your organization to:

	Not At All Instrumental		**Some Instrumental**		**Very Instrumental**	**N/A**	**DK**
a) Access new business opportunities nationally?	1	2	3	4	5	8	9
b) Access new business opportunities internationally?	1	2	3	4	5	8	9
c) Develop new business alliances or to strengthen existing business alliances?	1	2	3	4	5	8	9

4. Did the skills and technologies which your organization acquired during the STDP R&D projects enhance the company's technology base?
   - *Provide examples please?*
5. How have the STDP R&D projects contributed to job creation/retention in your organisation and in the Canadian space industry?
   - *number of jobs created during the project*
   - *number of jobs retained after the project*
6. What types of revenues have the STDP R&D projects created for your organisation?
   - *percentage of total revenue?*
7. How have the technologies and knowledge developed through STDP contracts been used by the CSA? Please provide examples when applicable.
   - *missions made possible;*
   - *missions made easier to carry through;*
   - *risks reduced or eliminated; and*
   - *cost savings generated from the use of STDP project results.*
8. Has the STDP generated any unintended impacts, results or benefits for your group, for the agency, for companies and/or other stakeholders? Please provide examples and explain if these were positive or not.
9. To what extent would your organisations' STDP funded projects have been undertaken and/or completed if you did not have access to STDP funding?
   - *The research would not have been done at all?*
   - *The research would have been completed with a smaller budget, but with a smaller scope?*
   - *The research would have proceeded?*
10. To what extent has the STDP provided your organisation with financial leveraging opportunities for its R&D projects?

No Financial Leveraging		**Some Financial Leveraging**		**Significant Financial Leveraging**	**N/A**	**DK**
1	2	3	4	5	8	9

11. Using the following rating scale, how satisfied are you with the following aspects of the STDP program?

	Not At All Satisfied		Somewhat Satisfied		Very Satisfied	N/A	DK
a) The involvement of the Canadian space industry in the selection of priority technologies for research?	1	2	3	4	5	8	9
b) The efficiency of the RFP process?	1	2	3	4	5	8	9
c) The fairness of the selection process?	1	2	3	4	5	8	9
d) Companies' access to STDP contracts?	1	2	3	4	5	8	9
e) The clarity of project reporting requirements (e.g.,) to the CSA?	1	2	3	4	5	8	9
f) The time required to address project reporting requirements to the CSA?	1	2	3	4	5	8	9

12. What type of support do Canadian space industry organizations such as yours require from the STDP and other sources to undertake these types of R&D projects? Do organizations currently have access to these supports and from what sources?
13. What would be the impacts on both the CSA's Canadian Space missions and the Canadian Space industry if the STDP was cancelled?
14. Are there any other items with respect to the STDP that you would wish to discuss with our team?

Thank you for your assistance in this important evaluation.

Evaluation of the Space Technologies Development Program

Interview Guide – Public Works and Government Services Canada (PWGSC)

Introduction

The Canadian Space Agency (CSA) has asked Government Consulting Services (GCS) to conduct the evaluation of the Space Technologies Development Program (STDP). This evaluation will help to inform future decisions related to the program.

As part of the evaluation, GCS is conducting interviews with different stakeholders, such as the CSA, companies from the Canadian Space Sector and other federal departments playing a role in the STDP. The purpose of this interview is to talk about is to provide you with an opportunity to discuss the STDP's contracting processes, issues or obstacles relevant to this process, as well as other areas you may wish to discuss relevant to this CSA program.

The following questions will serve as a guide for our interview. In some cases, questions may not be relevant to your particular situation or experience. The interview will focus on those questions most relevant to you.

Please also note that the responses you provide are confidential and will not be attributed to you in the evaluation report (only aggregate information will be released) or in any documentation provided to the CSA.

INTERVIEW QUESTIONS

Background

1. What is your role at PWGSC and how long have you been in this position as well as working for PWGSC?
2. How is your work at PWGSC related to the STDP program and how long have you been providing services to the CSA?
3. Is there a need for a coordinated approach to R&D contracts within the CSA? Please explain why this is or is not required. (1.2) - NEW
4. Does the nature of the STDP, the types of contracts being awarded or other facets of the program create unique obstacles or delays to PWGSC completing its contracting role? If so, would you have suggestions on overcoming these obstacles or delays?
5. In your experience, is the STDP functioning efficiently with respect to its processes and procedures? What should be highlighted as functioning well and what could be improved? (7.1)
    - *RFP process, selection criteria, management framework*
    - *Adherence to Government Contracting Regulations*
    - *Companies access to STDP contracts and commercial opportunities*
    - *Contracts reflect the SOW and RFPs*
    - *Results of the R&D projects reflect the objectives of the contracts*
    - *Other areas?*
6. What steps could be or have been taken to improve the STDP's contracting process? Have these been implemented? (7.2)
7. Are you aware of alternative processes/approaches available to the CSA better suited to the realities of the STDP program (i.e. nature of the program being based upon research and development and the requirement to be able to quickly adapt to changes in technology)?
8. Are there any other items with respect to the STDP that you would wish to discuss with our team?

Thank you for your assistance in this important evaluation.

Industry Success Stories

STDP evaluation

STDP Funded Technology

1. Please describe a technology(ies) that was developed through STDP funding that your company would consider a success for one or more of the following reasons:
    - Technology has been incorporated into a space mission (Canadian participated mission or initiator of foreign mission)
    - Resulted in significant commercial revenues for your company
    - Technology developed represents a key business line(s) for your company
    - Technology was spun into other commercial products that are key to you company

    PROBE:

    - *identification of new markets that were accessed (national vs international)*
    - *degree of evolution in the technology readiness (TRL)*
    - *impact of the technology on the Canadian Space Industry*
    - *was the technology used in a space mission in Canada or abroad*
    - *description of new capabilities developed through STDP contracts*

2. To what extent would your company have developed this technology had STDP funding not been available? How important is STDP to your organization?

    PROBE:

    - *space technology is high risk and market is limited, would not have proceeded without STDP funding*
    - *If would have proceeded, to what extent?*
    - *able to leverage funding from other sources*
    - *STDP funded projects provide credibility with other space agencies*

Financial Support/Revenues/Benefits Generated

3. Please describe the level of direct financial support provided by STDP in the development of this technology(ies)?

    PROBE:

    - *number and amount of STDP contracts received to develop this technology*
    - *breakdown of STDP funding vs company funding*
- *extent of contract: multi-year contract*

4. *What other type of support provided by* the STDP contributed to the commercial success and viability of this project:

    PROBE:

- *have developed an increased 'know-how' that has been applied to other projects*
- *access to national and international networks*
- *increasing credibility and knowledge through working forums and expert groups*
- *introduction to new potential clients/key stakeholders*

5. What are the direct revenues accumulated to date from the technology?

   PROBE:

   - *What percentage of these revenues would you attribute to STDP funding?*
   - *What percentage of the R&D budget may be designated as 'CSA funding'?*

6. What are the direct expected revenues to be generated from this project(s) (in the next 5 years)?

   PROBE:

   - *What percentage of these revenues would you attribute to STDP funding?*

7. What has been the impact on employment within your organization from sales or use of technology from the project (or technological area)?

   i. *no impact*
   ii. *new jobs were created*
   iii. *How many to date?*
   iv. *new jobs were maintained*
   v. *amount of jobs that were created from spin-off technology*
   vi. *How many to date?*

8. *What percentage* of all company sales could be attributed to the technological advances that resulted from the STDP support?

Qualitative Benefits/Spin-Off Technologies

9. Please list and describe any spin-off technologies derived from the STDP-funded technology? What has been the impact for your organization (e.g., revenues, FTEs)

10. How was your company able to take the technology developed and establish it commercially? Please explain.

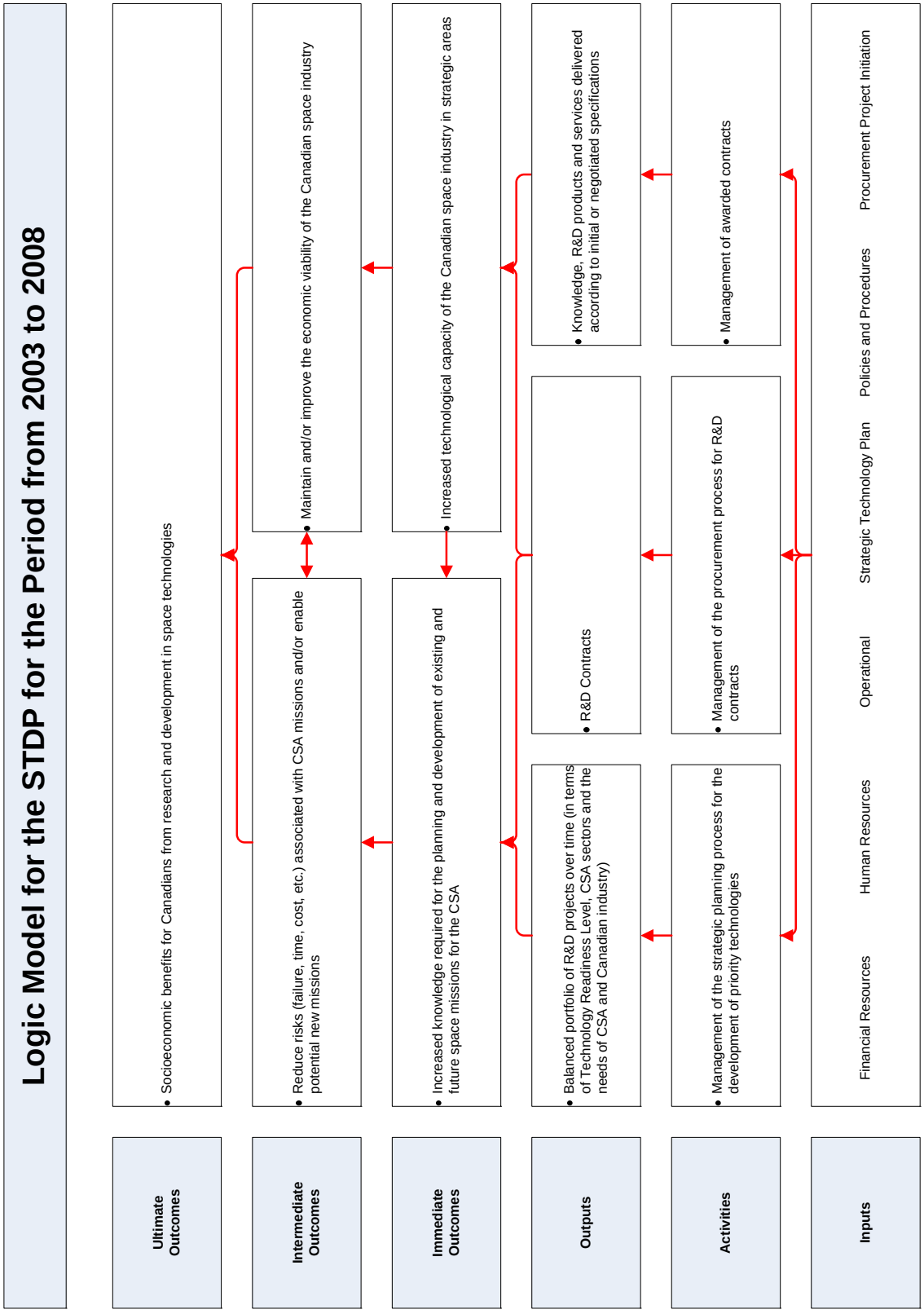
    PROBE:

    - *Other government programs (e.g., Industrial Research Assistance Program (IRAP-NRC) and Strategic Aerospace and Defence Initiative (SADI- IC)*
    - *Company funds*

11. Are there any other items with respect to the mentioned technologies that you would like to discuss with our team?

Thank you for your assistance in this case study

Appendix D – Revised STDP Logic Model



Appendix E – Management Action Plan

Ref.	RECOMMENDATIONS	RESPONSIBILITY IDENTIFIED		DETAILS OF ACTION PLAN	TIMETABLE
		ORGANIZATION	FUNCTION		
RECOMMENDATIONS					
Greater clarity regarding the objectives of the program is needed.		*CSA – Space Science and Technology – Technology Development Management Group*	Head STDP	- Restrict use of contracts to identified CSA technological needs - Within the approved G&C authorities, STDP will be tailored to support the development of industrial capabilities/capacities - Train personnel on use of G&C authorities - Establish functional framework to use transfer payments (SOP, Roles & Responsibilities, selection process, repayment guidelines, risk evaluation, etc.)	March 2012
CSA needs to clearly map all R&D technology requirements related to proposed missions.		*CSA – Space Science and Technology*	Manager of Technology Planning (TBD)	- CSA Technology Planning group will define and implement a standardized process through which technology developments needs will be identified, mapped, prioritized and funded.	September 2011
STDP personnel and PWGSC need to clearly map the procurement and contracting process, roles of each party, service standards, and their		- *STDP Personnel and PWGSC*	Head STDP	- CSA working group established and lead by CSA's CFO to address CSA wide PWGSC issues Two main tools	Done

Ref.	RECOMMENDATIONS	RESPONSIBILITY IDENTIFIED		DETAILS OF ACTION PLAN	TIMETABLE
		ORGANIZATION	FUNCTION		
requirements				(documents) are available that help resolve the issue raised in this recommendation: o Major Steps in the Contract Approval Process o Generic Procurement Process - PWGSC Departmental Authority (Excel file included roles & responsibilities and schedule)	
Further study on the possibility of introducing a two-step application process: 1) letter of interest and 2) complete proposal if requested		*CSA – Space Science and Technology – Technology Development Management Group*	Head STDP	- Will be considered for G&C authorities - For R&D procured through PWGSC, the new technology priorities/requirements process will provide sufficient guidelines for more pertinent proposals and therefore although this recommendation was valid for the period of the evaluation, it is no longer deemed valid	- March 2012 - Done
Provide guidance and support to companies regarding the preparation of proposals (e.g., templates, sample proposals, workshops, etc.)		*CSA – Space Science and Technology – Technology Development Management Group*	Head STDP	- Although instructions to bidders are provided with all STDP RFP's there might be a need to add this topic to our next Technology Days Workshop. The last one was held in Oct 2008.	On-Going
A formal communication		*CSA – Space*	Head STDP	- Identification of a	- Done

Ref.	RECOMMENDATIONS	RESPONSIBILITY IDENTIFIED		DETAILS OF ACTION PLAN	TIMETABLE
		ORGANIZATION	FUNCTION		
	strategy for communication of project results to interested CSA parties	*Science and Technology – Technology Development Management Group*		"client" for every technology priority - Client consulted/invited to kick-off - Client will receive copies of Final Review Packages - Client satisfaction report produced	- Done - On-going - June 2011