



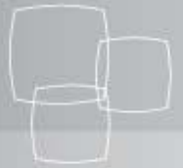
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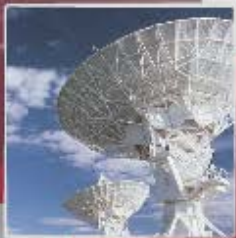
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Strategic Aerospace and Defence Initiative



Program Highlights 2013-2014



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Initiative stratégique pour l'aérospatiale et la défense (ISAD) — Faits saillants du programme 2013-2014



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1. Introduction

Canada's aerospace, defence, space and security (aerospace and defence) industries are major contributors to our nation's economy and important global players. In 2010, Canada's aerospace manufacturing sector was ranked 5th among OECD countries in terms of revenues and GDP, with \$22.8 billion in direct revenue and more than 700 companies across the country.¹ This industry supported more than 170,000 direct, indirect and induced jobs in the Canadian economy in 2012, including approximately 73,000 direct jobs.² In 2011, the defence industry generated \$9.4 billion in revenues, and supported 64,000 full-time jobs across the country³.

In the global marketplace, research and development is a key driver of economic growth, and innovative companies are more likely than others to be part of that growth. Research and development allows Canada to compete in new markets and industries, and helps Canadian businesses offer their customers new or improved products, processes and services. With annual research and development investments of more than \$1.6 billion each year⁴, the aerospace sector is the second most research-intensive industry in Canada.⁵

Research and development benefits individual Canadians too, through economic development, employment opportunities, and the potential environmental and safety benefits of new or improved technologies (for example: better fuel efficiency, reduced emissions, and enhanced emergency communications capabilities).

The 2013 report by the Canadian Council of Academies, *The State of Industrial R&D in Canada*, identified aerospace products and parts manufacturing as one of Canada's industrial research and development strengths.⁶ Canadian companies must continue to invest aggressively in research and development to remain competitive and on the leading edge of new innovations.

The Strategic Aerospace and Defence Initiative (SADI) accelerates innovation by Canadian aerospace and defence companies which results in economic, technological and social benefits for Canadians. The program provides repayable contributions in support of strategic industrial and pre-competitive research and development. SADI was launched in 2007 and is delivered by the Industrial Technologies Office (ITO) of Industry Canada.

This report highlights developments in 2013-2014.

¹ 2013 Report: The State of the Canadian Aerospace Industry, Aerospace Industries Association of Canada (AIAC)

² Ibid

³ Export Strategy for Defence Procurement: <http://www.international.gc.ca/media/comm/news-communiques/2014/02/pw-tp-bg.aspx?lang=eng>

⁴ Aerospace Review, Beyond the Horizon: Canada's Interests and Future in Aerospace, November 2012, pg 13: http://aerospacereview.ca/eic/site/060.nsf/eng/h_00033.html

⁵ Aerospace Review, Beyond the Horizon: Canada's Interests and Future in Aerospace, November 2012, pg 1; http://aerospacereview.ca/eic/site/060.nsf/eng/h_00033.html

⁶ The State of Industrial R&D in Canada, Canadian Council of Academies, 2013, pg 118

2. Supporting the Government of Canada's Science and Technology Strategy

On December 4, 2014, the Government of Canada launched the newly updated Science, Technology and Innovation Strategy: *Seizing Canada's Moment: Moving Forward in Science, Technology and Innovation 2014*, which builds on the foundation laid out in the 2007 Science and Technology framework, but goes further to ensure that Canada remains well positioned in the global arena for research excellence, talent and wealth.

This updated strategy leverages the expertise and resources of post-secondary institutions, industry and government to translate brilliant theories and ideas into applications that will improve the day-to-day lives of Canadians and generate economic growth and jobs across the country. It is guided by four core principles: promoting world-leading excellence, focusing on targeted priorities, fostering partnerships and enhancing accountability.

Since 2006, the Government has provided more than \$11 billion in new resources to support basic and applied research, talent development, research infrastructure, and innovative activities in the private sector, including more effectively aligning federal support for research with business needs⁷.

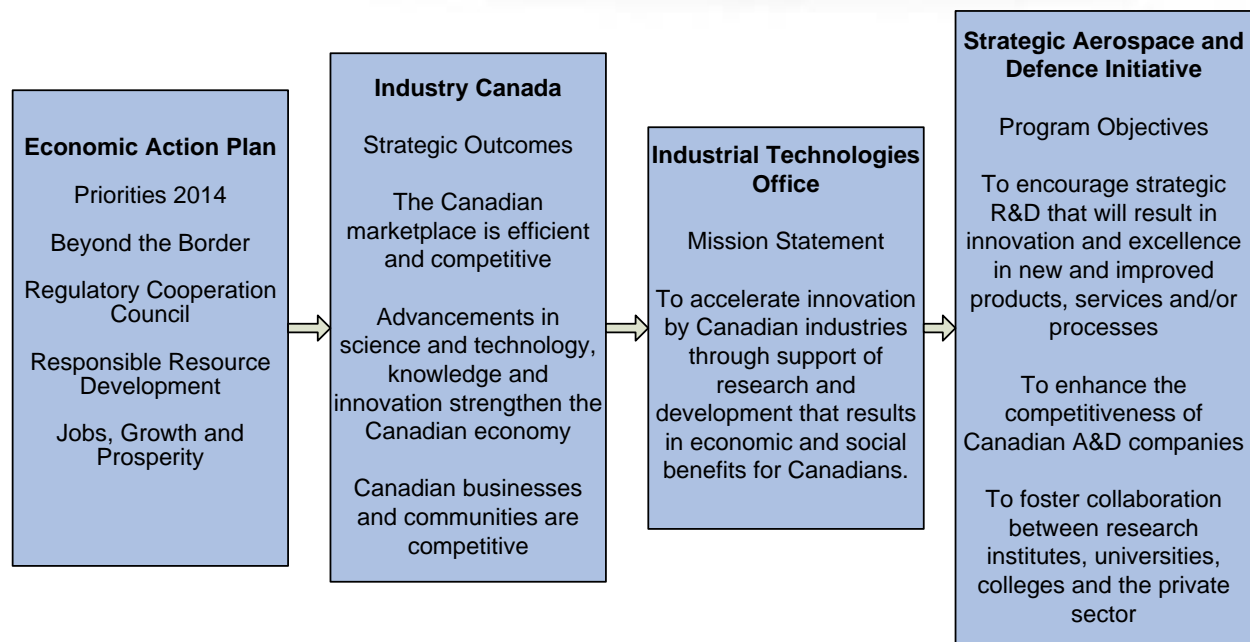
SADI is an important part of the federal government's commitment to research and development and to encouraging strategic partnerships and collaboration among companies and research institutions. These commitments are key components of Industry Canada's mission, which is to foster a growing, competitive, knowledge-based Canadian economy.

By making repayable contributions in strategic industrial and pre-competitive research and development projects, SADI helps create a supportive environment in which Canadian companies can develop advanced products, services, processes and technologies. These efforts benefit not only the company conducting the research and development, but also other companies throughout the aerospace and defence supply chain and the Canadian economy as a whole, through technology transfer and other spill-over benefits.

At the same time, by nurturing private sector research and development at home, SADI helps Canadian companies of all sizes remain competitive in the global economy.

⁷ Government of Canada Budget Plan 2014 *The Road to Balance: Creating Jobs and Opportunities*, pg 113: <http://www.budget.gc.ca/2014/docs/plan/pdf/budget2014-eng.pdf>

Figure 1. How SADI relates to the Government of Canada's Priorities



3. SADI Overview

SADI provides repayable contributions to support strategic research and development among Canadian based aerospace and defence industries. By sharing in the risks and rewards of research and development, SADI supports innovation by Canadian aerospace and defence companies. The program also encourages private sector investment in research and development by increasing the amount of capital available for eligible projects.

SADI's three objectives

- (1) encourage strategic research and development that will result in innovation and excellence in new or improved products, services, and/or processes;
- (2) enhance the competitiveness of Canadian aerospace and defence companies; and
- (3) foster collaboration between research institutes, universities, colleges and the private sector.

Eligibility Criteria

- The applicant must be a for-profit corporation incorporated under Canadian law.
- The project must comprise research and development that takes place in Canada.
- At least one percent of total eligible project costs must be allocated to post-secondary institutions in Canada.

- The project must comprise industrial research or pre-competitive development.
- The project must include strategic research and development activities that support the development of next generation aerospace and defence products, services and/or processes, build on Canadian strengths in aerospace and defence technology development, enable Canadian companies to participate in major platforms and supply chains, and/or assist the aerospace and defence industries in achieving Canada's international obligations.
- The applicant must demonstrate that SADI funding is essential to the location, scope and/or timing of the proposed project.

Project Approval Process

Submission of the Application: SADI applications are accepted throughout the year using an on-line application form. There are no submission deadlines, nor contribution minimum/maximum amounts. Once the on-line application form is complete, it becomes the applicant's project proposal.

Eligibility and Completeness Screening: ITO screens each proposal to ensure that the project meets the eligibility requirements and that the proposal contains adequate information upon which to start a due diligence review.

Due Diligence Review: ITO evaluates the company's capability to achieve the economic and social benefits that it expects will result from the research and development activities, through an assessment of financial resources, management expertise, the business plan, technical feasibility, etc.

Project Approval: Final project approval rests with the Minister of Industry. Funding requests for more than \$10 million require Treasury Board approval. Funding requests for more than \$20 million require Cabinet and Treasury Board approvals. Once a project receives approval, a contribution agreement is signed by the recipient and the Crown outlining the legally binding obligations and responsibilities of both parties and the conditions under which payments will be made.

Repayment Terms

The SADI program provides repayable contributions, as opposed to loans, covering up to 40 percent of the total eligible project costs. Repayments are unconditional or based on the recipient's gross business revenue, begin two years after the completion of the research and development, and are typically repaid over a 15-year period. The maximum amount repayable is based on risk as calculated by ITO during the due diligence review.

SADI also supports projects under the Defence Development Sharing Agreement (DDSA) with the United States Department of Defense and the Joint Strike Fighter (JSF) program. SADI supports up to 40 percent of eligible project costs. The nominal amount (100 percent) of the contribution is payable over 15 years for DDSA and over 20 years for JSF projects.

Monitoring Process

Annual site visits, monthly or quarterly progress reports, annual financial statements and annual benefit reports allow ITO to monitor the progress of each project, with greater oversight in cases of large and higher risk projects.

4. Financial Framework

SADI's program funding comes from appropriations made available through the estimates process, and an authority to access repayments collected from SADI and the program that preceded it, Technology Partnerships Canada (TPC), which ended in 2006. In addition, for fiscal year 2013-14, the program budget included funding from the \$200 million over four years (2010-11 to 2013-14) announced in 2009. The budget for 2013-14 was \$234 million.

As of March 31, 2014, a total of \$1.16 billion in authorized assistance had been approved under SADI, of which \$748 million* had been disbursed against eligible claims.

ITO's operating expenses for the management of SADI and TPC were \$5.6 million in 2013-14. Operating expenses cover salaries, audits, site visits, employee training, outreach and other administrative program requirements.

Program Resources by Fiscal Year (\$000)

Fiscal Year	ITO Operating Expenses **	SADI Annual Contribution Disbursements ***	TPC Annual Contribution Disbursements ***
2007-08	12,660	10,500	256,553
2008-09	12,635	35,783	198,813
2009-10	12,369	62,035	130,916
2010-11	10,596	114,558	46,726
2011-12	7,784	163,675	25,194
2012-13	5,591	199,095	17,210
2013-14	5,554	182,045	1,230

* The amount of \$748 million corresponds to the total amount disbursed under SADI at the end of fiscal year 2013-14.

**Represents total operating costs for the management of SADI and TPC.

*** As presented in the Annual Public Accounts of Canada. The amount reported in the Annual Public Accounts of Canada includes actual disbursements made in each fiscal year and estimates for disbursements to be made related to expenses incurred in those years.

5. SADI Project Portfolio

As of March 31, 2014 the SADI portfolio was comprised of 34 projects (with 27 recipients) and a combined authorized assistance of \$1.16 billion. The authorized assistance ranged from \$276,000 to \$300 million per project. Many projects are still in the research and development phase and have yet to enter the repayment phase.

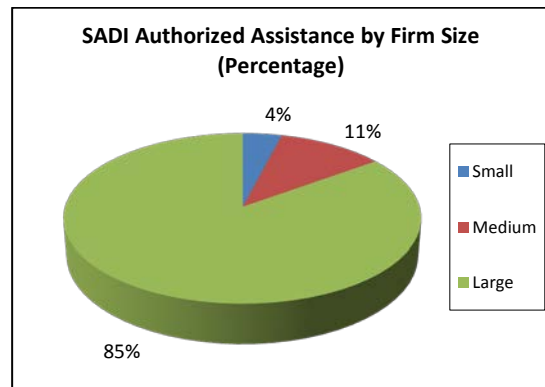
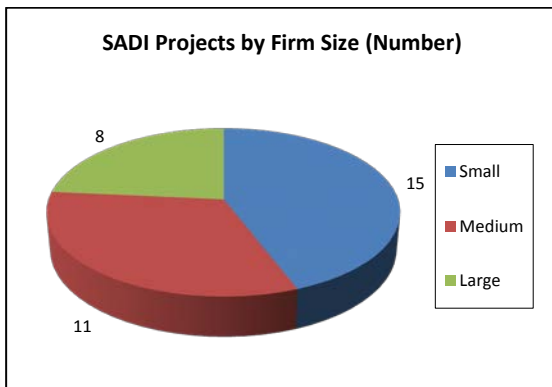
SADI Project Portfolio				
Status	# of Projects	Authorized Assistance (\$)	Disbursements (\$)	Repayments (\$)
Research and Development Phase	19	988,776,716	606,408,136	N/A; projects in Research and Development Phase
Repayment Phase*	11	118,108,624	115,184,998	5,064,110
Inactive **	4	48,220,991	26,898,860	6,162,957
Total	34	1,155,106,331	748,491,994	11,227,067

*Repayments begin one to two years after the completion of the research and development, in accordance with the terms of the contribution agreement. The first year SADI projects entered this phase was in 2011-12 and repayments are forecasted to increase significantly in future years.

**Includes projects that have been terminated and for which both the company and the department have agreed to terminate the contribution agreement, due to different circumstances, including a change in the control of the company, cessation of operations, bankruptcy or receivership. One project is excluded from this list because it was cancelled before any funds were disbursed.

SADI provides contributions to companies of all sizes

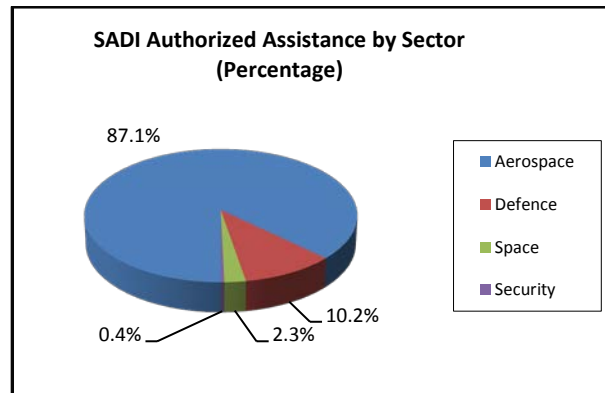
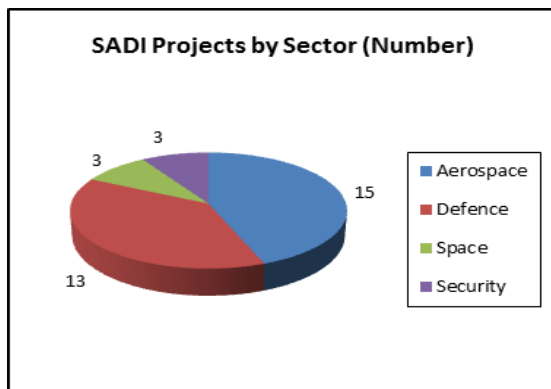
Of the 34 SADI projects, small companies with less than 100 employees accounted for 15 projects and four percent of the authorized assistance; medium-sized companies with 100-500 employees accounted for 11 projects and 11 percent of the authorized assistance; and large companies with more than 500 employees accounted for eight projects and 85 percent of the authorized assistance.



SADI supports the aerospace, space, defence, and security sectors:

Of the 34 SADI projects:

- 15 projects supported the aerospace sector accounting for 87 percent of the authorized assistance;
- 13 projects supported the defence sector accounting for 10 percent of the authorized assistance;
- three projects supported the space sector accounting for two percent of the authorized assistance; and
- three projects supported the security sector accounting for less than one percent of the authorized assistance.



SADI supports Canada's international objectives

Of the 34 SADI projects, five are developing new technologies for the Joint Strike Fighter (JSF) program and three are developing technologies for the government of the United States under the Defense Development Sharing Agreement (DDSA), a testament to the strength of Canadian companies in their respective niches.

- The five JSF projects account for 15 percent of SADI's portfolio and six percent of authorized assistance.
- The three DDSA projects account for nine percent of SADI's portfolio and 0.1 percent of authorized assistance.

SADI Portfolio

Company		Project Description	Authorized Assistance *
2007-2008			
1	Diamond D-Jet Corporation	Single-engine, five-passenger jet aircraft	\$19,600,000
2008-2009			
2	Integran Technologies Inc.	Nanotechnology enabled tooling	\$4,596,000
3	Magellan Aerospace Limited	Structural components for the F-35	\$43,391,600
4	Héroux Devtek Inc.	Advanced landing gear technology	\$26,964,430
5	Norsat International Inc.	Microwave, wireless & portable satellite technologies	\$5,975,200
6	CMC Electronics Inc.	Integrated cockpit & communications system	\$52,287,784
7	EMS Technologies Canada Ltd.	Next generation mobile satellite communications	\$8,718,634
8	SkyWave Mobile Communications Inc.	Fleet management, shipping security	\$3,127,200
9	CAE Inc.	Enhanced simulation technology	\$250,000,000
10	Sputtek Inc.	Advanced protective coating technologies	\$360,285
2009-2010			
11	AXYS Technologies Inc.	Unifying data from monitoring & surveillance sources	\$1,836,900
12	PCI Geomatics	Earth observation information extraction	\$7,665,000
13	BelAir Networks Inc.	Radio technology with advanced security	\$9,690,706
14	Kongsberg Mesotech Ltd.	Acoustic instrumentation for underwater security	\$4,968,000
15	Integran Technologies Inc.	Cadmium replacement coatings	\$276,284
16	Integran Technologies Inc.	Hard chrome alternative	\$807,399
2010-2011			
17	2154331 Canada Inc.	Flight simulation	\$18,570,000
18	D-TA Systems Inc.	Advanced sensor processing	\$1,790,140
19	ASCO Aerospace Canada Ltd.	Structural components for the F-35	\$7,688,288
20	Pratt & Whitney Canada Corp.	Gas turbine engine applications	\$300,000,000
21	Thales Canada Inc.	Fly-By-Wire flight control system	\$12,988,800
22	FLYHT Aerospace Solutions Ltd.	Automated flight information reporting system	\$1,967,507
23	Ultra Electronics Canada Inc.	Tactical high capacity radio	\$32,447,400
2011-2012			
24	Integran Technologies Inc.	Nanostructured alloys as an alternative to copper beryllium	\$399,386
2012-2013			
25	Engineering Services Inc. (ESI)	Intelligent security robot	\$778,800
26	GasTOPS Ltd.	Oil systems diagnostics	\$1,275,000
27	NGRAIN	3D tools	\$9,500,000
28	Héroux Devtek Inc.	Advanced landing gear technology	\$48,957,693
29	Norsat International Inc.	Improvements to satellite terminals, microwave components & radio frequency antennas	\$13,270,265
2013-2014			
30	AXYS Technologies Inc.	Port waterside application & data	\$2,000,000
31	Dominis Engineering Ltd.	Naval propulsion impellers & high skew monoblock propellers	\$544,500
32	Ultra Electronics Maritime Systems Inc.	Advanced underwater sensing systems	\$8,231,222
33	CAE Inc.	Project Innovate	\$250,000,000
34	Avcorp Industries Inc.	Advanced metal-bond manufacturing capability development	\$4,431,208

* **Authorized Assistance** represents the maximum amount contracted at the time of the initial contribution agreement. Actual amounts disbursed may be lower than the maximum allowed.

6. SADI Results

SADI's Performance Measurement Strategy identifies performance indicators for each of the program's three objectives: innovation, competitiveness and collaboration. This section reports on the overall progress of recipients in meeting program objectives. For descriptions at a project level, please see Annex A.

Innovation

By March 31, 2014, 27 out of 34 projects resulted in the development of new or improved products, services, processes and/or technologies. In some cases, the entire project was not completed, but an element of it was completed and efforts had begun to commercialize or put into use the new technology. Many projects are in the research and development phase and are making good progress in achieving the activities outlined in their Statement of Work, as defined within each contribution agreement and summarized under Annex A.

In terms of the overall reporting⁸ portfolio, 100 percent of projects being undertaken by large companies have resulted in the development of a new or improved product, service and/or process, 80 percent by medium-sized companies and 92 per cent by small companies, demonstrating that the majority of companies have been successful to date in significantly advancing their research and development work, regardless of the company size.

Strategies for protecting the technological developments enabled by SADI projects differ from company to company. Formal intellectual property protection, such as patenting, was used by a little more than a third of funding recipients while most companies relied on trade secrecy to protect the outcomes of their SADI research projects. To date, among those companies which did make use of formal intellectual property protection, on average, companies applied for nearly four patents (and were granted one), with the exception of one company which had a heavy focus on patenting.

As of March 31, 2014, \$748 million of approved funding has been disbursed against eligible claims since the program's inception, leveraging over \$1.4 billion from other sources to accelerate innovation in Canada, or \$1.89 per SADI dollar disbursed (against a program target of \$1.60).

Competitiveness

As of March 31, 2014, 19 out of 34 projects resulted in the successful commercialization of new and improved products, services, processes and/or technologies.

⁸ The reporting portfolio represents 30 SADI projects that have reported annually on benefits achieved (cumulatively) as of March 31, 2014. The remaining projects (four) are those that have only recently been approved, and as such, have not yet completed a reporting cycle.

As described in Annex A, companies are progressing well in their early days of exploring new market opportunities. They are beginning to generate economic benefits to recipients and broader economic and other benefits, including environmental benefits.

An important indicator of competitiveness is the ability of a Canadian subsidiary of a multinational corporation to maintain or establish a research and development or production mandate⁹ in Canada. When this occurs it demonstrates that the research and development work related to the SADI project has in part enabled the subsidiary to maintain or improve its leadership in its area of expertise.

Seven SADI recipient companies are subsidiaries of multinational corporations. As a result of their SADI project, 71 percent reported being able to maintain a current research and development or production mandate. Further, 43 percent of these subsidiaries reported being able to establish a new research and development or production mandate. In many cases, if a subsidiary obtained the research and development mandate, it also obtained the production mandate for the resulting product, service, process or technology.

Most recipient companies also reported other outcomes, as a result of their SADI project(s), that had a positive impact on their ability to compete. Companies reported an average of six positive competitiveness outcomes per project. The top four reported outcomes were: the ability to invest in training and skill development; the ability to penetrate new markets or sectors; an increase in number of customers; and the ability to invest in machinery, equipment and information and communications technologies.

Environmental advancements have also been achieved. As of March 31, 2014, twenty-five SADI projects have resulted in environmental efficiencies in areas such as energy consumption, production and material usage.

Collaboration

When companies undertake collaborative research and development with universities and colleges, the benefits extend beyond the goals of the specific project, resulting in a stronger alignment of research interests, training of the next generation of researchers and engineers, acceleration of innovation, improved access to research infrastructure, and increased student employment. By March 31, 2014, 28 out of 34 projects resulted in collaborations with various universities, colleges and affiliated research institutes. The target over the research and development phase of each project is to have all recipients engage in meaningful collaboration.

Some key collaboration results to date include:

- 23 projects have resulted in students being temporarily employed in the company (for the duration, or part of the duration, of the project).

⁹ A mandate is a business, or an element of a business, in which the subsidiary participates and for which it has responsibilities beyond its national market.

- 17 projects have resulted in hiring students on a permanent basis as employees of the company.
- Seven projects have included supporting research chairs at universities.
- 10 projects have included supporting research laboratories.

The larger the company (in terms of employee size), the larger the number of students, research chairs and research labs supported. However, companies of all sizes benefitted from collaboration. More than 75 percent of all companies reported hiring students temporarily as part of their SADI projects. A higher proportion of large and small companies, as compared to medium-sized companies, hired students on a permanent basis as employees of their company.

To date, 73 percent of companies with projects that have completed the research and development phase have reported continuing with the collaborative relationships established during the SADI project. This demonstrates that companies are steadfast in their commitment to engage the research community and others beyond the SADI project.

7. 2013-2014 Highlights

Aerospace Review: Beyond the Horizon: Canada's Interests and Future in Aerospace

In 2011, the government launched a review of the aerospace and space sector. On November 29, 2012, David Emerson, head of the review, publicly released his reports, *Beyond the Horizon: Canada's Interests and Future in Aerospace* and *Reaching Higher: Canada's Interests and Future in Space*. These reports made recommendations to government to improve the long-term competitiveness of the sector.

Reflecting extensive consultation with industry, the report concluded that SADI is an essential tool in the government's tool box for helping companies finance research and development in Canada at levels they would not otherwise be able to justify given other demands on their resources. In the case of multinational companies, the report noted that SADI encourages research and development to be performed in Canada when it might otherwise be undertaken elsewhere.

The report recommended that the government maintain SADI funding at current levels and that modifications be made to improve the effectiveness of the program.

In response to the review, Economic Action Plan 2013 announced stable funding of almost \$1 billion for SADI over the next five years and that a review of the SADI program would be undertaken to improve its effectiveness.

To enhance the incentive for the private sector to invest in research and development and reduce administrative burden, the government announced changes to the SADI program in December 2013. These changes included:

- Delaying the start of repayment for new SADI projects by one additional year to give companies approximately two years to tap into markets instead of one. This will better align repayments with the recipient's ability to realize project benefits, standardize the approach for all SADI projects, and increase repayments to the crown.
- Establishing a shorter service standard for companies with less than 100 employees and projects applying for contributions of less than \$2 million. A shorter service standard will reduce the administrative burden of the program, result in more applications from small businesses, and enhance support for small business innovation in Canada.
- Increasing Industry Canada support to 40 percent of eligible project costs. This increase will provide greater risk sharing, standardize the approach for all companies, and incent more companies to undertake R&D.
- Supporting overhead at a rate of 75 percent of direct labour. This will reduce administrative burden, standardize the approach for all companies, and result in more support for the direct cost of innovation.
- Requiring recipients to make contractual commitments to locate high-value activity in Canada over the 15 year repayment period. This will generate significant benefits to Canada in terms of securing high skilled and high paying jobs.

The aerospace review also recommended the creation of a program to support, on a non-repayable basis, large-scale aerospace technology demonstration projects conducted by groups of collaborators.

Technology Demonstration Program (TDP)

In keeping with the Emerson report recommendation, on September 4, 2013, the Minister of Industry launched the TDP, fulfilling a key recommendation of the Aerospace Review. The program supports large-scale technology demonstration projects conducted by groups of collaborators and will leverage other investments of sufficient scale to accelerate innovation in the aerospace, defence, space and security sectors. Projects funded through TDP are expected to be the basis for the next-generation of manufacturing and services in Canada, and bring long-term benefits to Canada.

Demonstration activities involve moving new technologies out of the laboratory in order to test them to ensure that they fulfill their intended use in a safe and efficient manner. This is a critical phase in the pre-commercial development of technologies for new aerospace and defence products. Companies often find it difficult to finance this step in the technology development process, limiting the speed and scale with which innovation is advanced.

The program will align the research agendas of industry and academia, giving students relevant study/work experience and accelerating the diffusion of knowledge. The program will also provide for a technology development environment where project members have the opportunity

to share resources and prove their technologies simultaneously, thus accelerating technology development and minimizing development costs.

The TDP uses a two-stage competitive process to solicit applications from industry in order to award a non-repayable contribution to one or more large scale projects per year, up to a maximum of \$54 million. Companies are first invited to submit a Statement of Interest. Those successful through this process are then invited to submit full proposals. Applications are evaluated against seven criteria: Economic Benefits to Canada, Broader Benefits to Canada, Collaboration, Innovation, Management and Technological Capability, Financial Capability, and Post Project Commitment. Together with an in-depth assessment of each proposal by subject matter experts, an interdepartmental and multi-disciplinary review is performed at each stage.

In September 2013 the first call for Statements of Interest under the TDP was announced. The proposals submitted are currently in the due diligence phase, with project announcements expected in Winter 2015. The second call for Statements of Interest was issued June 2, 2014.

Further details on the TDP can be found at <http://ito.ic.gc.ca/eic/site/ito-oti.nsf/eng/Home>

New Agreements

AXYS Technologies Inc.

The government approved a \$2 million repayable contribution to AXYS Technologies Inc. This Sydney, British Columbia-based company is developing a new maritime surveillance technology. This project will help the company develop applications that collect, analyze and display sensitive maritime data to enhance port and harbour security. Users will be able to monitor potential criminal threats in real time. Ultimately, the project will make ports and harbours safer around the world.

The full press release can be found at: <http://news.gc.ca/web/article-en.do?nid=764959>

Ultra Electronics Maritime Systems Inc.

The government approved a repayable contribution of \$8.2 million to Dartmouth-based Ultra Electronics Maritime Systems Inc. The contribution will support a research and development project to develop next generation sonar technologies. The company will collaborate with research institutes at Canadian universities in carrying out this project, which involves building smaller, lighter versions of existing sonar systems, with improved capabilities and performance. The full press release can be found at: <http://news.gc.ca/web/article-en.do?nid=768709>

CAE Inc.

The government approved a repayable contribution of \$250 million to CAE Inc. The contribution will support a research and development project to develop new simulation technology for its next-generation civilian and military aircraft flight simulators. This project will enable CAE to update and modernize its flight simulation software, which the military can use to simulate missions and train its forces at lower costs.

The full press release can be found at: <http://news.gc.ca/web/article-en.do?mthd=tp&crtr.page=1&nid=819329&crtr.tp1D=1>

Avcorp Industries Inc.

The government approved a repayable contribution of \$4.4 million to Avcorp Industries Inc. The project will develop new technologies in metal bonding which it will use to manufacture new aircraft components, such as structural panels, rudders and wing parts. This multi-year project will help the company gain a competitive advantage through cost-effective, advanced manufacturing. The project will provide work for Avcorp's suppliers as well as valuable hands-on experience for the university students selected to work on the project.

The full press release can be found at: http://news.gc.ca/web/article-en.do?mthd=index&crtr.page=1&nid=840719&_ga=1.7402994.1111990948.1393513338

Dominis Engineering Ltd.

The government approved a repayable contribution of \$544,500 to Dominis Engineering Ltd. The Ottawa-based company will perform research and development to create an innovative new production process for large naval propellers. The project will allow Dominis to expand the market opportunities for its state-of-the-art marine products and keep the firm at the forefront of marine technology advances, where innovation is essential for long-term competitiveness.

The full press release can be found at: <http://news.gc.ca/web/article-en.do?nid=865189>

Service Standards

ITO is committed to continual improvement with regard to service delivery standards. These standards are aimed at improving the quality and timeliness of its service. ITO staff work with clients to ensure that information requirements and processes are well understood so that these objectives can be met.

Table 4: ITO Service Standards

Service Standard	2010-11	2011-12	2012-13	2013-14
<u>Application Assistance Response Time</u> - Respond within one business day to requests for assistance with a project application. Target: 100%	100%	100%	100%	89%
<u>Claims Processing Time</u> - Process completed claims and release the payment within 45 calendar days. Target: 90%	93%	100%	89%	100%
<u>Application Processing Time</u> - Complete the proposal review and provide a funding decision within 6 months of receiving a completed application for applications requesting less than \$10 million. Target: 100%	1 out of 3 projects was approved within 6 months	1 out of 1 project was approved within 6 months	1 out of 3 projects was approved within 6 months	3 out of 4 projects were approved within 6 months
<u>Amendment Processing Time</u> - Process an amendment and provide an approved amended agreement within 6 months. Target: 90%	n/a	n/a	90%	43%

We aim to respond to requests for information from the public within one business day. This applies to requests received via phone or email (contact information is available on ITO's website). In 2013-2014, we achieved this target 89 percent of the time.

Our target is to process claims within 45 days, 90 percent of the time. In 2013-14, 117 claims were submitted and 100 percent of them were processed within the 45 day period.

While we strive to complete the processing of applications for under \$10 million within the six month service standard, we do not compromise our due diligence and take the necessary time required to ensure an appropriate review. Out of the five agreements approved in 2013-14, four were under \$10 million, of which three were approved within six months. More time was required to complete the appropriate review and assessment of the fourth project.

In 2013-14, ITO processed 43 percent of all amendments to existing contribution agreements within six months. Processing times for amendments in some instances exceeded the standards. In each case, the complexity of the project and/or negotiations necessitated additional rigour and time.

Service standards results are published annually on ITO's website at <http://ito.ic.gc.ca/eic/site/ito-oti.nsf/eng/00734.html>

Recipient Audits

In 2013-14, ITO performed a total of 16 SADI and TPC project audits: two cost audits, thirteen revenue audits and one lobbyist audit. Projects were selected for audit based on risk and materiality. The projects audited are part of a multi-year audit plan which identifies audits planned for the period ending 2016-17. Recipients were found to be in compliance with the conditions of the contribution agreements and where audit issues were found, all were resolved satisfactorily.

8. Conclusion

SADI is fulfilling its key objectives: encouraging innovation through research and development excellence, enhancing the competitiveness of Canadian companies, and fostering collaboration between the private sector, research institutions and universities.

Although many SADI projects are currently in the research and development phase, significant progress is already being made toward achieving benefits to Canada.

Business priorities for 2014-15 include continued efforts to increase SADI program awareness and investments, and a continued commitment to service excellence.

ANNEX A

The majority of projects in the SADI portfolio are in the research and development (R&D) phase. Economic and social benefits are expected from the research and subsequent commercialization of the innovation over the 20-year life cycle of an average project.

This annex provides an update on the status of projects that have been undertaking their R&D for at least one year (i.e. projects contracted before 2013-2014), as well as projects that entered the repayment phase, and those that became inactive, in 2013-2014. Projects contracted in 2013-14 are listed in section 7 of this report.

PROJECTS IN THE RESEARCH AND DEVELOPMENT PHASE (2007/08 – 2013/14)

ASCO AEROSPACE CANADA LTD. (ASCO Canada)

Location: Delta, BC

Authorized SADI Assistance: \$7,688,288

Contribution Agreement: October 25, 2010

Innovation: The objective of the project is to test and verify new manufacturing processes for machining titanium which can be incorporated on the Lockheed F-35 Joint Strike Fighter (JSF) bulkhead production parts. Continuing studies are required to monitor elements such as tool life to ensure that the processes are not only technically effective, but also cost effective. As part of the SADI project, ASCO Canada purchased a Macbormill machine (a high-speed milling machine) which is now operational and enhances ASCO Canada's capabilities to produce aircraft more efficiently. As a result of its new capabilities, ASCO Canada was asked, on behalf of the JSF program, to provide additional quotations in early 2014 for both machining and assembly work.

Collaboration: Since the beginning of the project, ASCO Canada has maintained a co-op partnership with the University of British Columbia and has recruited five post-graduate students into its operations. In May 2011, ASCO Canada started a joint R&D project with the National Research Council (NRC) to study deep pocket/slotting titanium machining with very small diameter tools. The research project was completed by year end, and involved three NRC engineers and three ASCO Canada engineers.

Economic and Other Benefits: This project has allowed ASCO Canada to retain twenty highly-skilled and experienced technical staff, all of whom are expected to be retained. This project will enable ASCO Canada to compete for additional JSF work and in the future adapt the processes developed to other aerospace markets. The processes developed under this project have allowed ASCO Canada to participate in the JSF spar processes (process to develop the main structure of the JSF aircraft wing). The company is also looking for other applications for the processes and technical expertise being developed. Processes developed under this project will enable ASCO Canada to maintain a competitive edge over the global competition. During the

project, ASCO Canada implemented additional waste reclamation and recycling programs, dramatically reducing industrial waste and minimizing its ecological footprint by 20 percent.

AXYS TECHNOLOGIES INC.

Location: Sidney, British Columbia

Authorized SADI Assistance: \$1,836,900

Contribution Agreement: August 5, 2009

Innovation: The objective of this project was to research and develop a system to integrate and manage data from various maritime monitoring and surveillance sources to provide comprehensive real-time information. This provides a unified view of the maritime domain and enhances port and waterside security. The innovative aspect of this project involved developing the system's ability to receive information from various sources, integrate the data and present it to users and decision-makers in real time. As of March 31, 2014, this project is considered complete with several installations around the world including Canada, Saudi Arabia, New Zealand and Ecuador.

Collaboration: AXYS has collaborated with the University of Victoria, Camosun College and Memorial University of Newfoundland. In addition, AXYS continues to engage engineering co-op students in its research and development activities. AXYS has also been working with the Port of Prince Rupert to enhance its waterside monitoring and surveillance program and is collaborating with JASCO Research and Ocean Sonics in the area of marine underwater acoustic surveillance. Since project completion, AXYS has engaged with the Canadian Hydrographic Service with regard to data sharing services.

Economic and Other Benefits: With SADI support, AXYS has been able to develop a highly innovative product to help defence and security organizations, port operators and other stakeholders improve maritime surveillance and security and respond promptly to security incidents such as undesired vessel movements, discharge of pollutants at sea, oil spills and severe weather threats. AXYS has also seen its sales and workforce grow. Its technology has allowed for better maritime domain decision-making, and for the provision of better information to stakeholders and improved microclimate data delivery.

CAE INC.

Location: Saint-Laurent, Quebec

Authorized SADI Assistance: \$250,000,000

Contribution Agreement: March 30, 2009

Innovation: The objective of this project was to improve CAE's existing modelling and simulation technologies to develop simulators for a wider range of aircraft. This project has resulted in further development of CAE's core modeling and simulation technologies and the introduction of several innovative products and services across a broad spectrum of aerospace and defence applications. These innovations have allowed for a number of new trademarks to be registered and patent applications to be filed and granted.

Innovations developed include: a new Full Flight and Mission Helicopter for single and dual-pilot seating introduced as the CAE 3000 Series platform; a next-generation Dynamic Synthetic Environment™ which allows changes in the synthetic environment, such as weapons, weather or the latest intelligence from the real world, to be reflected dynamically; the Augmented Visionics System, which provides pilots with a synthetic virtual representation of the environment around them; the next generation of Magnetic Anomaly Detection – Extended Role which can be mounted on lighter platforms such as on Unmanned Aerial Vehicles; and the development of an Unmanned Aerial System (UAS) Mission Trainer which combines an open architecture with commercial off-the-shelf hardware and simulation software to provide a comprehensive, platform-agnostic training system (meaning it runs equally well across more than one platform) for UAS pilots, sensor operators, and mission commanders.

Collaboration: CAE uses a collaborative model of technological development that benefits universities and research facilities. The company has made contributions in excess of \$7 million for collaborative projects with universities and research institutes including: a McGill University Research Chair; Carleton University's Centre for Advanced Studies in Visualization and Simulation; and CAE's Augmented Engineering Environment Software/Development Laboratory at École Polytechnique de Montréal. CAE has also launched collaborations with Ottawa and McMaster Universities, the Consortium for Research and Innovation in Aerospace in Quebec, the National Research Council of Canada and the Institut national d'optique.

Economic and Other Benefits: CAE has introduced new aircraft simulation platforms including the 3000 Series full-flight simulator technology and CAE's Visual System Tropos-6000. In addition, technology developed under this project has allowed CAE to collaborate with Bombardier Aerospace for its CSeries platform, Global 7000 and Global 8000 aircraft programs, the Aviation Industry Corporation of China (AVIC) for the new AVIC Medium-Sized Transport aircraft, the Mitsubishi Aircraft Corporation for the Mitsubishi Regional Jet, and AgustaWestland for the AW189 full-flight simulator.

Modelling and simulation applications have been leveraged into defence and security applications, notably PRESAGIS products which were featured at the 2010 Vancouver Olympics. CAE is expanding professional services offerings, applying modelling and simulation to achieve safety, security and efficiency/productivity benefits for entire nations, such as Brunei. Project know-how in complex algorithmic modeling and evidence-based training has also been applied in healthcare and mining markets.

This project has also strengthened CAE's Canadian supply chain through partnerships with Canadian industrial partners and suppliers.

CAE's simulation product platforms have contributed to a better environment through the use of new composite materials to reduce material footprints, and electric motion and vibration systems. In addition, wide-body aircraft pilot training allows savings of between 7,500 and 14,000 litres of fuel and 6.6 metric tons of CO₂ for every hour of training. Noise and other negative impacts are also mitigated.

D-TA SYSTEMS INC.

Location: Ottawa, Ontario

Authorized SADI Assistance: \$1,790,140

Contribution Agreement: August 25, 2010

Innovation: This project involved research and development of products that convert high frequency analog signals from systems such as radio, radar and sonar into digital data for computers. This conversion will enable real-time processing and display and will reduce the cost and deployment time for complex systems. It will also allow D-TA to customize products to meet the requirements of defence communications users in Canada and the United States. The project is now complete and D-TA has developed four products.

Collaboration: D-TA founded Carleton University's Dipak and Tara Roy Sensor Processing Laboratory in November 2011. This laboratory supports graduate research and facilitates advanced research in sensor processing to develop concepts, algorithms and system architectures for a variety of applications, including: radio, radar, sonar, wireless, medical imaging and instruments, and other areas of interest to communication, defence and aerospace sectors. Five students have benefited from D-TA guidance and supervision and access to company facilities, one of whom was recruited as a full-time employee. D-TA also delivered a consulting report to the Agency for Defense Development in South Korea with the support of a Carleton University engineering faculty member. The university interaction is a huge step in skill development in the field of advanced signal processing.

Economic and Other Benefits: The R&D project has increased D-TA's visibility in the defence market and enhanced its competitiveness. D-TA won several projects with the US Department of Defense and the Canadian Department of National Defence. D-TA's configured solutions are significantly reducing deployment time and costs for system integration, software development and system testing. D-TA's solutions also allow customers to reach the point of field trials in six to nine months instead of two to three years. A number of high-paying jobs have been created through this project. The entire R&D was undertaken in Canada including with Canadian based sub-contractors and 90 percent of D-TA's suppliers are located in Canada.

ENGINEERING SERVICES INC. (ESI)

Location: Toronto, Ontario

Authorized SADI Assistance: \$778,800

Contribution Agreement: December 6, 2012

Innovation: The objective of this project is to develop a mobile robot for patrolling, under remote control, private and public buildings, private premises for commercial and residential use, and open space and areas used by the public officially, commercially or privately. The robot will operate with limited human supervision, and will be integrated within networks of public or private security systems. The proposed technology will reduce the human resource cost and increase the quality of services. As a result of the SADI funding, ESI will develop a proof-of-

principle demonstration prototype. The project is currently on schedule and a patent application is in progress.

Collaboration: ESI will involve four engineering students in this project (three from the University of Toronto and one from McMaster University) to work on engineering design. The students will be active members of the engineering design team and the work will provide the students with exposure to the engineering profession and an opportunity to apply classroom theory to real design problems.

Economic and Other Benefits: Once completed, it is expected that the resulting product will expand the use of robotics for applications to the security industry sector and among supply chain partners. The project will demonstrate the capability to introduce automation (including some human hands-on interaction) in order to broaden and improve services and mitigate human resource shortfalls. The project is allowing ESI to enhance its skills development in autonomous navigation of mobile robots as well as increase its competitiveness in being able to showcase a product in a new business domain.

GASTOPS LTD.

Location: Ottawa, Ontario

Authorized SADI Assistance: \$1,275,700

Contribution Agreement: September 28, 2012

Innovation: The project involves research and development in the area of Laser Induced Breakdown Spectroscopy with the objective of developing the capability to measure the concentration of metallic contaminants in jet engine oil. The project goal is to develop a prototype portable instrument that will enable aircraft maintenance personnel to measure contaminants on the ground beside an aircraft rather than in a lab or another location. The instrument would provide air maintenance personnel with an immediate engine health assessment.

Collaboration: As part of the project, GasTOPS will engage a co-op student for the duration of the project and will collaborate with Queen's and Carleton universities.

Economic and Social Benefits: GasTOPS is one of the few small and medium-sized enterprises qualified and able to provide supplier-designed articles in the Joint Strike Fighter Program. This project will enhance the company's capability in this regard and will generate additional opportunities across the aerospace market.

HÉROUX-DEVTEK INC.

Location: Longueuil, Quebec

Authorized SADI Assistance: \$48,957,693

Contribution Agreement: February 21, 2013

Innovation: The Héroux-Devtek Inc. (HDI) project will integrate new technologies into landing gear design and allow HDI to become a Tier 1 supplier of complete systems. Tier 1 suppliers are responsible for delivering complete systems to original equipment manufacturers. A growing requirement for aerospace industry clients is the use of new materials and processes to make finished products and manufacturing processes more environmentally sustainable. Building on its solid past experience as a supplier of machined parts and its previous R and D programs, HDI intends to carry out this project by grouping the technologies to be developed into four categories.

All of the activities complement each other and will ensure that HDI's primary objective is achieved. They will also be aimed at eliminating or reducing environmentally harmful processes, reducing greenhouse gas emissions, reducing the environmental footprint and improving the life cycle of landing gear, during design, manufacture, operation, maintenance and overhaul. On the project completion date, HDI will be able to offer a "ready-to-use" unit to the company assembling the aircraft. HDI therefore proposes acquiring knowledge on how to integrate the various landing gear systems, from the landing gear lever in the cockpit to the tire.

This is why HDI is developing sub-systems of new technology, such as the landing gear integrity monitoring system, weight-on-wheels detection, advanced shock absorption, and electrical operation of the landing gear, as well as integrating the various landing gear systems, including the various electronic boxes such as the brake control, steering control, emergency control and landing gear control systems.

Collaboration: The project will bring significant technological benefits to the academic and research communities. During this project, HDI intends to collaborate with various universities and technical colleges such as McGill, ETS, École Polytechnique, Laval and Concordia, at a cost of \$1.5 million. HDI is working in partnership with several other Canadian companies as part of the Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ), Mitacs-Accélération, etc. These collaborative projects provide major support that promotes knowledge sharing, training and selecting technical labour before they enter the job market.

To date, HDI has formed a partnership with the Aerospace Technology Centre to develop a process for manufacturing parts made of composite. An agreement has been signed with Laval University for integrated modelling of a shock absorber cylinder for landing gear that is made of aluminum. HDI has also signed an agreement with McGill University in relation to the project for manufacturing composite parts.

Another agreement has been signed with Clumeq to help develop calculation tools using HDI's high-performance computer and help accelerate the modelling process for certain projects such as the aero-acoustic project.

As part of this project, HDI has hired 18 interns to date, one of whom obtained a permanent position with HDI.

Economic and Other Benefits: This project will enable HDI to provide clients with new materials and processes intended to make finished products and manufacturing processes more environmentally sustainable.

It is certain that the planned projects, such as the project “Integration of new technologies into the design of landing gear – Phase II” will greatly enhance HDI’s competitiveness and competition in the market. HDI’s market shares have increased considerably in recent years, which is why it is focusing on new technology that will enable it to increase its value proposition. HDI is currently ranked third in the world among landing gear suppliers. HDI’s objective is to be number one and offer a viable alternative in the market.

KONGSBERG MESOTECH LTD.

Location: Port Coquitlam, British Columbia

Authorized SADI Assistance: \$4,968,000

Contribution Agreement: February 23, 2010

Innovation: Kongsberg Mesotech Ltd. (KML) is developing its next generation of sonar for the purposes of monitoring and classifying threats to ports and high-value marine assets. These high resolution images will also be used for mine detection, avoidance and counter measure. The sonar being developed has proven itself in trials and has been utilized for various other industries (fisheries, oil and gas, engineering) with favorable results. KML’s sonar designs use advanced telemetry and data processing in order to obtain the most detailed images as fast as possible. The unique imaging technology of the M3 sonar developed under this project has been protected with patents.

Collaboration: KML has employed co-op students and Post Doctorates from Simon Fraser University and provided funding for a PhD student at the University of Victoria for the development of imaging technology. KML is also considering supporting a chair position within the University of Victoria for marine engineering and sciences. KML is assessing the potential to engage a Post Doctoral fellow at the University of British Columbia for using sonar and acoustics for material characterization and possibly classification.

Economic and Social Benefits: To date, KML has commercialized one model of its M3 sonar which has a wide range of abilities and operable depths. A dual axis single beam sonar system to acquire profile points for 3D point cloud rendering and modeling has been released to production with use in port security and clearance as well as commercial engineering applications. A 1MHz 1171 single beam sonar system for high resolution imaging has been released to production for use by police and first responders for evidence recovery and security applications. The product’s versatility has also been used within the fisheries market for stock assessment and monitoring through the use of fish tags.

MAGELLAN AEROSPACE LIMITED

Location: Winnipeg, Manitoba

Authorized SADI Assistance: \$43,391,600

Contribution Agreement: September 1, 2008

Innovation: The objective of the project is to undertake the research and development of new processes for composite manufacturing and complex assemblies that incorporate both composite and metallic components. This project is related to the multinational Joint Strike Fighter (JSF) program. The complexity and precision, essential to produce the parts that go into an F-35 JSF, requires specific technologies. For example, the aircraft design demands exactness such that on the multiple pieces that are assembled for the horizontal tail assembly, almost 1,400 holes have to align within one-half thousandth of an inch, which is 1/6th the thickness of a piece of paper. The first units produced by Magellan were sent to the United Kingdom for final assembly and met specifications. In December 2012, Magellan delivered the first F-35A Horizontal Tail Assembly from the Winnipeg facility. The first flight of Magellan's first assembly took place in February 2014. The technology required to complete this engineering feat, and do it repeatedly and efficiently, continues to improve with new equipment, software updates and new processes, all supported by SADI.

Collaboration: Working with Red River College, Magellan opened the Centre for Non-Destructive Inspection Technologies, which is located on the College's Industrial Campus at Magellan Aerospace. This state-of-the-art centre allows students and professors to learn and experience laser technology that inspects carbon fibre parts up to 85 percent faster and is found nowhere else in Canada. Development collaboration is also being done with the University of Manitoba and the Composite Innovation Centre, in Winnipeg, Manitoba.

Economic and Other Benefits: Magellan is advancing its manufacturing capabilities with leading-edge equipment in state-of-the-art facilities, and continues to develop technologies that provide an opportunity for many years of work. These precision machining, composite work, and inspection technologies provide employment in highly-skilled manufacturing jobs and world-class learning opportunities for students and faculty. With the international participation associated with the JSF program, Magellan is gaining global recognition for its accomplishments in applying advanced technology in a production environment. Many design, engineering and affordability changes continue to happen as the F-35 JSF proceeds with flight testing. Magellan expects this phase of the program to last a few more years, and continues to seek better ways of producing the various products being manufactured. Low-rate production of Magellan built units are currently undergoing in-flight testing, with full-rate production of the JSF program expected in 2019.

NGRAIN (CANADA) CORPORATION

Location: Vancouver, British Columbia

Authorized SADI Assistance: \$9,500,000

Contribution Agreement: October 30, 2012

Innovation: The objective of this project is to develop the 3D tools and application framework necessary to drive the next generation of aircraft by developing interactive 3D simulation software that will assist in technical training and operational support, and provide the most true-to-life virtual hands-on experience to users. The new software will be used to guide workers through repair jobs, and will help reduce equipment maintenance time. The interface and user experience will be improved with increased functionality, realism, and wherever possible, take advantage of other platforms' capabilities (such as the touch interface or tracking capabilities of the iPad/android).

Progress to date has included new augmented reality products and visual analytic demonstrations. NGRAIN software is used in the development of the F35 Joint Strike Fighter, and in the development of the F22 stealth fighter in the US.

Collaboration: NGRAIN plans to collaborate with a variety of Canadian education and private sector companies in pursuit of the objectives envisioned for this project. This includes working with the University of Toronto, University of Alberta, Algonquin College, University of British Columbia and the British Columbia Institute of Technology. To date, NGRAIN has worked with the University of Toronto on laser scanning, 3D rendering and mobile deployment of simulations. The company is also currently engaged in outlining new initiatives with the World Bank, Boeing and Convergent Technology.

Economic and Other Benefits: The SADI program is helping NGRAIN advance its technology more rapidly than otherwise would have been possible. In addition to funding specific lines of advanced research, it has facilitated collaboration with other Canadian educational and business enterprises that would not have otherwise occurred. With SADI support, NGRAIN has been able to invest in new hardware including 3D printers and wearable devices, which have put NGRAIN at the forefront of rapidly expanding, augmented reality and visual analytics (big data) markets. As a result, NGRAIN has developed long-term significant business relationships with Lockheed Martin, the Department of National Defence and others. For example, many members of the Canadian Armed Forces around the world are using NGRAIN technology to make their jobs safer and more efficient.

The software developed through this project is expected to provide growth opportunities for the Canadian high-tech industry and will enable companies to increase their level of technology development and create new knowledge-based jobs across diverse industry segments. Many of the 3D modelling and training technologies developed could be adapted to other industries (e.g. automotive production, civil aviation, nuclear power, oil and gas, and medicine), allowing users to increase productivity, reduce costs and become more competitive.

NORSAT INTERNATIONAL INC.

Location: Richmond, British Columbia

Authorized SADI Assistance: \$13,270,265

Contribution Agreement: March 28, 2013

Innovation: The objective of this project is to increase Norsat's capabilities in the production of satellite terminals, components and wireless components to maintain its leadership position within the aerospace and defence industry. The project is enabling Norsat to expand its line of microwave components and improve existing product performance. In particular, Norsat has developed and refined the industry leading ATOM line of Ku band transmitter products for use in satellite user ground stations, which enables the transmission and reception of microwave radio signals to and from satellites for audio, video or digital processing. In addition, the project has enabled Norsat to develop a low-cost antenna system capable of operation across X, Ku and Ka bands.

The project has allowed the company to design and build a flat panel antenna prototype which will address the challenges of tracking a satellite from a moving vehicle. This is a challenging technology and will require several iterations of design and prototype development. The project has also enabled Norsat to develop the Sentinel RMC, a platform ideal for any application requiring remote real-time data monitoring and control, allowing Norsat to enter into the M2M (machine to machine) oil and gas industry for the first time.

As part of this project, the Outdoor Transmission Kit (OTK) was created to support Norsat's line of portable office products. These products provide access to accessories and services such as internet connectivity, phones, printers and more. The OTK provides remote transmission capability that can withstand harsh environmental conditions, making them ideal for first responders globally.

The SADI project has also enabled Norsat to develop innovative new filters and antennas within the wireless communications market. In particular, a large effort was spent on the research and development of ceramic resonator filters which allows for smaller filters that are important at low frequencies where typical filters are quite large. This product development has created a new level of space efficiency in multi-channel combining requirements and can be used for public safety systems globally. Temperature compensation still remains a challenge however, and additional research is required. In addition to developing new filters, the SADI project has enabled Norsat to develop new wideband antennas for the land mobile radio market.

Collaboration: Norsat has collaborated with Simon Fraser University (SFU) to develop antenna components including the flat panel antenna prototype. Norsat used the Sierra Wireless Laboratory (Antenna Measurements Lab at SFU) to characterize the Norsat 1m reflector and feed for Asiasat certification. The flat panel prototype was also characterized at SFU.

Norsat collaborated with Kratos Systems and Solutions Inc. on the ATOM Radio Frequency product line which kick-started the development of products for the microwave product line.

Economic and Other Benefits: Some additional benefits of the project include enabling Norsat to expand its microwave product line and create the environment needed for the further development of these products. SADI has supported Norsat in the update of its test and measurement equipment with a new Vector Network Analyzer and Signal Generator. The project has enabled Norsat to expand its Canadian supply chain in support of its new ATOM Radio Frequency products. Norsat used many local contractors to complete prototypes including printed circuit board manufacturers, machine shops and cable assembly shops.

The SADI project is helping to position Norsat to be successful in the wireless communications market by being the first to market with innovative new products. It will also enable Norsat to retain and increase its workforce.

PCI GEOMATICS INC.

Location: Richmond Hill, Ontario

Authorized SADI Assistance: \$7,665,000

Contribution Agreement: August 12, 2009

Innovation: The objective of this project is to research and develop a high-speed computing framework and software suite that will make it possible to process large amounts of raw satellite image data faster and more cost-effectively, with an emphasis on increasing the automation of image processing. The resulting data are essential for decision-making in many fields, including aerospace and defence, environmental monitoring, agriculture, security and intelligence, and wide-area surveillance. Through this SADI project, PCI has enhanced its capabilities in this field and continues to work on researching and developing new technologies for the marketplace.

Collaboration: PCI is engaged in an ongoing collaboration with Queen's University on a project researching feature extraction from Very High Resolution remote sensing imagery. Previously, PCI completed a collaboration project with the University of Ottawa under the SME4SME program in the exploration of visual attention models in the context of satellite imaging. Other investigations and engagements undertaken by PCI as part of this SADI project include an exploration into the area of neural net computation applications in high resolution earth observation imagery with the University of Toronto, and a collaboration with the University of New Brunswick in the area of optical and radar image processing.

Economic and Other Benefits: SADI funding has aided PCI in enhancing technologies, most notably the Geomatica and GeoImaging Accelerator products, allowing them to enter the marketplace at a faster rate. Recent improvements to the software products have increased the efficiency of many data processing workflows, resulting in savings of time, energy and computing resources to PCI software users. SADI assistance has also enabled PCI to apply more resources to technology development, improve the quality of its product releases and expand its range of offerings to new technologies. Technology development undertaken with the assistance of SADI funding has resulted in software products that are capable of processing and managing large volumes of geospatial data quickly, accurately and at a lower cost than previously possible.

PRATT & WHITNEY CANADA CORP. (P&WC)

Location: Longueuil, Quebec

Authorized SADI Assistance: \$300,000,000

Contribution Agreement: December 10, 2010

Innovation: P&WC is developing aircraft engines that are lighter, more powerful, and offer better fuel consumption and improved durability, enabled by technologies related to lighter materials, high temperature coatings, next generation combustors, novel compressor architectures and intelligent engine controls and advanced manufacturing technologies. The company is developing cleaner, quieter engines which, in many cases, will exceed the noise and emission standards in the industry. The technologies developed in this project are being demonstrated in next generation platforms, such as regional turboprop and large business jets. The quality of the innovation is reflected in over 60 patents granted per year.

Collaboration: The company has established and maintained collaborative relationships with a large number of universities, research institutions and industrial partners in Canada, providing significant annual contributions to universities and research institutions. They have been recognized by the Science Technology and Innovation Council as a leader in strategic collaboration. On a yearly basis, P&WC conducts over 200 collaborative projects with 17 universities across Canada, engaging well over 400 students through different programs.

P&WC participates in seven NSERC industrial research chairs established at universities in British Columbia, Nova Scotia, Ontario, and Quebec and five consortia and research networks, such as Consortium for Research and Innovation in Aerospace in Quebec (CRIAQ), which enhance university expertise and develop Canadian supply chains. In addition, P&WC has established ten university Centres of Expertise and has been instrumental in the creation of Undergraduate Aerospace Institutes at six universities in Ontario and Quebec. All collaborative initiatives contribute to advancing university expertise, expanding the capability of the supply chain, and developing the next generation of aerospace professionals in Canada.

Economic and Other Benefits: Since the start of the project, the technologies developed have led to the certification of a new PT6A turboprop engine, which builds upon the PT6A legacy. The PT6A-140 offers more power to extend its capabilities for missions with higher altitudes and a 5 percent improvement in specific fuel consumption, through the incorporation of advanced aerodynamics, a more efficient compressor, and the latest generation of hot section materials. Other innovations have reduced emissions, increased maintenance intervals and further enhanced ease of operation with the introduction of digital electronic control to small gas turbine engines. These new technologies are delivering additional benefits such as reduction of noise and elimination of materials of concern to the environment. In its next generation regional turboprop, these new technologies are resulting in significantly lower fuel consumption. Through the use of fewer raw materials, increased automation and more efficient manufacturing processes, the company is lowering its use of energy and reducing its production of pollutants. In addition, the project provides development opportunities for the company's already highly skilled workforce and its research and industrial partners. Since the beginning of this project, over 1400 engineering employees have increased their technical skills through formal training. P&WC

employees are actively participating in over 130 technical committees and aerospace associations to shape the future of the aerospace industry.

THALES CANADA INC.

Location: Saint-Laurent, Quebec

Authorized SADI Assistance: \$12,988,800

Contribution Agreement: December 23, 2010

Innovation: The objective of the project was to research and develop a full Fly-By-Wire (FBW) flight control system that is lighter and more reliable than the standard flight control systems. This project supported the development of three new technologies related to the Bi-directional 429 bus, Flight Control Computer and Back-up Flight Control Unit. Three related products were also developed: the V3 Flight Control Computer, the Flight Control Computer and the Back-up Flight Control Unit. As of March 31, 2014, the research and development phase of this project is considered complete.

Collaboration: Thales has been involved in several collaborative projects with the Consortium de recherche et innovation en aérospatiale au Québec (CRIAQ), École Polytechnique de Montréal, McGill, and École de Technologie Supérieure for total research contributions exceeding \$690,000. Through these research projects there was an exchange of knowledge between the universities' researchers and Thales in the development of new prototypes. Finally, Thales also supported a minimum of five student internships each semester, providing firsthand experience in the field of aerospace. During the R&D project, 10 of these students were hired by Thales on a full-time basis.

Economic and Other Benefits: Thales's two new products, the Flight Control Computer and Backup Flight Control Unit are both available and ready for integration into commercial FBW aircraft. Their adaptability allow them to meet the needs of a wide range of regional and business FBW aircraft. Developments from this project helped create more reliable and lightweight flight control systems than the standard mechanical modules previously in use. In addition, lighter aircraft consume less fuel which reduces operating costs and provides environmental benefits through a reduction in aircraft exhaust.

ULTRA ELECTRONICS MARITIME SYSTEMS

Location: Dartmouth, Nova Scotia

Authorized SADI Assistance: \$8,231,222

Contribution Agreement: August 30, 2013

Innovation: The objective of this project is to develop next generation sonar technologies. Ultra Electronics Maritime Systems Inc (UEMS) will build smaller, lighter versions of existing sonar systems with improved capabilities and performance. The resulting products will introduce next-generation underwater sensing, data transport, and active sonar transduction technologies which will differentiate UEMS in the emerging low-frequency active sonar marketplace.

Thus far, one of the two new smaller low-frequency transducer technologies has been both modeled and prototyped with a piezoelectric (PZT) ceramic. Patent applications for this design are underway. In addition, internal acoustic transducer modelling capabilities have significantly improved. Smaller amplifiers suitable for the new smaller low-frequency transducer technologies have been designed and prototyped. Two new PZT vector sensor design alternatives have been modelled, and one has been prototyped. All of these innovations will enhance the ability of sonar technologies to transmit information efficiently.

Collaboration: The project has several post-secondary education collaborations. The largest is a collaboration with Simon Fraser University for a new microelectro mechanical systems (MEMS)-based accelerometer through a Natural Sciences and Engineering Research Council of Canada (NSERC) Collaborative research and development (R&D) grant which is valued at approximately \$1M in total between the Department of National Defence, Defence Research and Development Canada, NSERC, and UEMS. Over its duration, this will support one research engineer, two post-doctorate fellows, two PhD students, two Masters of Science students, and three Bachelor of Science students (hired as research assistants). This is a key element in developing smaller vector sensors for underwater operation. The next largest collaboration is the UEMS sponsorship of an NSERC Senior Industrial Research Chair at Dalhousie University in underwater digital communications. This activity has been on-going for 18 months and currently supports eight undergraduate students, four Masters students, one doctoral student, and two post-doctoral fellows.

Other collaborative R&D activities are underway with Dalhousie University on innovative options for modern towed bodies for sonar, and with the University of Calgary for novel methods of testing towed arrays in instrumented water tunnels and tow tanks, which supports one post-doctoral fellow. An NSERC Applied R&D activity is underway with the Nova Scotia Community College to define the effort required to regenerate an out-of-date low-frequency vector sensor calibration capability; this has supported five college students.

Economic and Other Benefits: The SADI assistance has allowed UEMS to significantly increase its R&D staff capacity with the following permanent staff: one recent PhD graduate in Physics, two recent Bachelor of Engineering graduates in Electrical Engineering, one senior Bachelor of Engineering in Mechanical Engineering, one recent Bachelor of Engineering graduate in Mechanical Engineering, one senior systems engineer, one senior project manager, and two mechanical technologists. The SADI assistance has been a significant factor in UEMS's ability to attract and retain this new intellectual capital. Furthermore, it is also expected that developments from this project will lead to lower acquisition and ownership costs for customers, and will increase the number of ships capable of supporting sonar products, thereby enhancing national defence capabilities.

ULTRA ELECTRONICS TCS INC.

Location: Montréal, Quebec,

Authorized SADI Assistance: \$32,447,400

Contribution Agreement: March 22, 2011

Innovation: Ultra TCS is developing a new generation of tactical radio systems, comprising wireless and mobile communication devices for military and government security applications. The company is on track with respect to developing a family of high capacity radios with unique features for different markets. New technologies under development include a platform that fully exploits the Software Defined Radio concept and a multiband/multichannel radio that integrates several communication technologies into one system. At the CANSEC tradeshow in May 2013, the company announced the launch of the ORION radio, its 4th generation of High-Capacity Line-of-Sight (HCLOS) radios. In October 2013, Ultra TCS was awarded a contract from the US Army to evaluate this new Canadian technology. The evaluation of the early production multiband/multichannel ORION radio was successfully completed in May 2014, confirming that the technology is reliable in very demanding operational conditions.

Innovation work is continuing with the development of mobile, overwater and mesh networking waveforms, in addition to aggressive SWaP (Size, Weight and Power) objective for which Ultra TCS is incorporating new filter and RF power amplification technologies. In January 2014, Ultra TCS applied to the PWGSC Built in Canada Innovation Program proposing to leverage these new overwater and SWaP technologies in a product aimed at market segments for Ultra TCS.

Collaboration: Ultra TCS is supporting an NSERC Industrial Research Chair in high performance wireless emergency tactical communications technology at the École de Technologie Supérieure (ETS). The Chair currently employs 2 institutional researchers, 2 Post-Doc fellows, 4 professional engineers, 12 PhD candidates, and 8 Masters Engineering candidates. This Chair has allowed many students to develop highly specialized expertise in wireless technology and to benefit from valuable internships in the industry. Since 2012, the company has also been contributing in-kind and cash to a three year NSERC project conducted jointly with AeroETS involving the use of autonomous UAV platforms as on-demand aerial repeaters.

The SADI-supported R&D projects are allowing Ultra TCS to maintain its ability to support co-op students and an NSERC Research Chair at ETS, and undergraduate and graduate level internship opportunities.

Economic and Other Benefits: The SADI-supported R&D projects are helping Ultra TCS achieve the market diversification that will ensure the company's future. The SADI support has also allowed Ultra TCS to enter the new fields of mobile mesh, maritime communications and autonomous aerial relays which are driving new research.

In 2013-14, 40 new frequency units derived from Ultra TCS's new High Capacity Radio, the first in the world to support both time and frequency duplexing, were purchased by the Department of National Defence, in addition to the number of units sold last year. These units

provide the Canadian Forces with a unique tri-band capable transmission system that can operate from 225MHz to 5000MHz. Ultra TCS is also bidding the High-Capacity Radio for a major tactical radio-relay procurement opportunity in India.

The development and production of the new ORION radio is enabling the company to continue to maintain a large base of Canadian suppliers to support design activities. More than 10 software and firmware design contractors contributed to this product with a significant level of hardware design subcontracted to Canadian companies. Discussions are ongoing for a broad international distribution of the product, and if the product is successful, it will enable Ultra TCS to keep technology jobs in Canada and provide leading-edge technology to Canada's military and public safety forces.

PROJECTS THAT ENTERED THE REPAYMENT PHASE IN 2013/14

HÉROUX-DEVTEK INC.

Location: Longueuil, Quebec

Authorized SADI Assistance: \$26,964,430

Contribution Agreement: September 2, 2008

Innovation: The Héroux-Devtek project consists of developing and integrating evolving technologies in landing gear systems to equip the next generation of aeroplanes.

With respect to material development, processes and the environment, the new material Ferrium S53 (a high-performance stainless steel), the replacement of cadmium plating with aluminum plating, and high-velocity oxy-flame (HVOF) (eliminating chrome plating) have been applied directly on the CH-53K helicopter. With these developments, Héroux-Devtek is demonstrating its unwavering commitment to the environment.

Héroux-Devtek has also been able to fully integrate engineering and manufacturing processes that are based on the solid analytical model in order to proceed directly to other key steps of the development process (structural analyses, dynamic analyses, manufacturing, parts inspection, etc.) and have been used to develop landing gear for such aircraft as LJ85, Legacy 450/500, CH-53K and F5X; another clear advantage over its competitors.

On these same landing gears, Héroux-Devtek has expanded the framework of its scope by developing and integrating much more comprehensive and complete solutions such as landing gear for helicopters, tail skid shock absorbers, door locking mechanisms, emergency release systems, hypersensitive detection systems, shear and torsion pins, complete control systems, and more. Héroux-Devtek's development team now has a greatly expanded range and capabilities, which means that the company can now definitively position itself as a key player in the global aeronautics industry, in spite of its relatively modest size as compared to the industry giants.

Collaboration: Héroux-Devtek has developed various types of partnerships to carry out the projects involved. For the project to eliminate the use of beryllium in rings and locking elements, the work was carried out with Alpha Casting (Montreal), which developed locking elements made of a cobalt alloy for testing and validation. By participating in this development, Alpha

Casting is aware of the design requirements for the parts in question and is thus ready to proceed to the production stage. The comparison with the copper-beryllium alloy will therefore lead to a solution that will allow industry to eliminate a harmful product (beryllium).

For the Composite project, Héroux-Devtek collaborated with an SME called Delastek, which has expertise in composite materials for other applications. With its involvement, HDI integrated expertise in other applications and gave Delastek the opportunity to develop new expertise in landing gear parts made of composite. The Aerospace Technology Centre (ATC) also contributed to this project to facilitate the transfer of technology. The ATC supplied equipment and personnel to perform tests according to HDI instructions and with the involvement of Delastek. The goal was to demonstrate the feasibility of the technology before its industrial implementation. This approach made it possible to prepare a future supplier for the type of parts developed.

Laval, Sherbrooke, Concordia, École Polytechnique, ETS, HECs, and Dawson College and Collège Bois de Boulogne were involved in various research projects, whether through participating in the projects or through master's or co-op students. A total of 35 student interns helped complete this project, and several students interned with the company twice. One person was hired after the project was completed.

Economic and Other Benefits: Through the SADI project, seven products were developed, five processes implemented and 15 technologies improved. This project, which maximizes landing gear design to reduce its weight, has had beneficial effects on the environment over the long term. The creation of full-time employment and hiring of co-op students has also led to long-term economic benefits.

True to its strategy of plant specialization, Héroux-Devtek has entrusted its manufacturing partners with manufacturing all of the parts that do not fall under the mandate of its own plants. Several landing gear parts for business aircraft are already manufactured by subcontractors. Consequently, a major part of production related to increased sales will be made using Héroux-Devtek's Canadian supplier base.

In the long term, the project will also enable the company to provide its clients with products at the cutting edge of technology, giving it a significant competitive advantage that will enable it to solidify its position as the third-ranked global player in the field of landing gear.

INTEGRAN TECHNOLOGIES INC

Location: Mississauga, Ontario

Authorized SADI Assistance: \$807,399

Contribution Agreement: March 24, 2010

Innovation: Integran has developed a proprietary and patented electrodeposition nanophase cobalt phosphorous product called Nanovate CoP as a replacement for Electrolytic Hard Chrome (EHC) in steel components used in aerospace applications. This product is an environmentally compliant alternative to EHC that exhibits significant performance enhancements, including

superior sliding wear, lubricity, corrosion protection and fatigue resistance while showing efficiencies over EHC. The greater efficiencies include lower power consumption and higher deposition rates resulting in a much smaller carbon footprint. This new product can be employed on, and adheres to, all standard (low carbon) steels, high strength steels and aluminum alloys and may equally be used in military and private sector products. Demonstration and validation components have been installed on the US Department of Defense (DoD) aircraft and are currently being evaluated for performance against strict military specifications. The plating specification and activation procedures as well as data acquisition with the US DoD remains ongoing. An Aerospace Materials Specification and a US DoD Mil-Spec are currently being approved.

Collaboration: Integran has collaborated with a number of Masters and PhD students from the Materials Engineering Department of the University of Toronto to leverage their knowledge, expertise and equipment. Students are given the opportunity to work in a real-world leading-edge environment in which to apply their skills and to learn new ones from actual hands-on applications.

Economic and Social Benefits: Integran has entered into a development licence with a Montreal-based aerospace company for gas turbine engine applications. Integran also extended licence exclusivity by five years to a major US manufacturer of hard chrome steel bars and tubes for the fluid power industry. Qualification and approval of the technology for use at the US DoD will guide supplier OEM requirements. Through industry collaboration and participation at technical conferences, presenting papers and publishing articles, Integran has engaged in interactions with all major aerospace landing gear and airframe companies. Integran is currently conducting prototyping programs which should lead to licensing opportunities. This new technology replaces existing hard chromium plating processes known to cause adverse health effects (ranging from skin ulcerations to lung cancer) and reduces greenhouse gas emissions and water pollution.

INTEGRAN TECHNOLOGIES INC

Location: Mississauga, Ontario

Authorized SADI Assistance: \$399,386

Contribution Agreement: March 15, 2012

Innovation: In this project, Integran developed and validated an electroforming process that produces a nanostructured alloy that matches the desirable properties of copper-beryllium, particularly for use as high load bushings but without the toxic properties of copper-beryllium. This pulsed electroplating process goes beyond merely coating a metal object. Rather, near-net-shape components are created that require little to no machining to achieve final dimensions, resulting in very little material waste. The work also showed this innovative process can be used successfully for large metal sheets and high conductivity wires, both of which are used in multiple military applications. The project exceeded the performance goals originally set out in the project. Demonstration and validation testing to advance the technology readiness level (TRL) beyond 5 is currently on-going.

Collaboration: Two engineering students from the University of Toronto were involved in this project. The students spent one year working at Integran as part of their program.

Economic and Social Benefits: The validation testing performed in this project demonstrates that these nanostructured alloys can meet or exceed the performance of copper beryllium in many applications, and could result in substantial cost savings for the Canadian and US DoD military through the decreased use of toxic substances. Once the demonstration and validation activities are completed, Integran expects to expand its product line and customer base, providing next-generation metal alloys that are more robust and free from toxic copper-beryllium alloys. In addition, qualification and approval of the technology (e.g. for use at the US DoD) will guide supplier OEM requirements. Integran has started to engage in interactions with major users of copper-beryllium (e.g. aerospace and defence companies) and will be conducting prototyping programs which are expected to lead to licensing and manufacturing opportunities.

PROJECTS THAT BECAME INACTIVE IN 2013-14

No SADI projects became inactive in 2013-2014.