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Years of Leadership in Technology Transfer

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FEDERAL PARTNERS IN TECHNOLOGY TRANSFER

Message from Morna Paterson Executive Director, FPTT



On behalf of the Federal Partners in Technology Transfer (FPTT), which this year celebrates its 10th year of success, I am pleased to present this special anniversary report.

This anniversary serves as an opportunity to rediscover how far we've journeyed to become the vital network of science-based practitioners that we are today. It also reminds us that, for as much as we have achieved, we have the talent to accomplish so much more.

Consider for a moment where we began. For almost 50 years, technology transfer revolved around a federal organization called Canadian Patent and Development Ltd., which assessed the inventions of government labs, processed patents and arranged the licensing of intellectual property. As convenient as it may have been, it was essentially reactive, rather than interactive or proactive.

In those days, government researcher involvement in their technologies and methods ended after they transferred them to CPDL. They neither expected, nor were they invited, to play a role in the exploitation of their inventions; they simply started their next project.

The Patent and Development office was dissolved in 1990. Without a central technology transfer infrastructure, each science-based department and agency was forced to set up its own. To say that was a daunting task is an understatement, for researchers were neither entrepreneurs nor specialists in intellectual property law. Much of their work involved knowledge disseminated for the public good, not for commercial exploitation.

That same year, several science-based departments and agencies created the Interdepartmental Group on Intellectual Property Management, which later became the Federal Partners in Technology Transfer.

And what exactly is FPTT? Quite simply, it is a lifeline that connects like-minded people to each other and to the world beyond at a time when

new technology can be obsolete in the time that it takes to file a patent.

FPTT is a catalyst and an advocate of a science-based membership increasingly called upon to advance the state of knowledge for the public good – in areas such as health, safety and the environment – as well as for the rapid transfer of technologies to the private sector for wealth creation.

It pools resources, reduces duplication, forges networks and inspires a climate of risk-taking based on sound science and good management. Through these and many other services, FPTT is helping us to understand that federal government intellectual property – and the empowered people who create and develop it – are strategic national assets.

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FPTT Partners

Agriculture and Agri-Food Canada
 Canadian Institutes of Health Research
 Canadian Space Agency
 Communications Research Centre Canada
 Environment Canada
 Fisheries and Oceans Canada
 Health Canada
 Industry Canada
 National Defence
 National Research Council Canada
 Natural Resources Canada
 Natural Sciences and Engineering Research Council Canada
 Public Health Agency of Canada
 Royal Canadian Mounted Police
 Transport Canada

Federal Government Intellectual Property Management Indicators, 1998-1999 to 2004-2005¹

	1997-98	1998-99	2000-01	2001-02	2002-03	2003-04	2004-05
Invention Disclosures	131	113	347	216	243	194	193
Patents							
Patent Applications	232	222	352	356	410	341	308
Patents Issued	130	89	110	133	142	178	169
Patents In Force	1,950	1,946	1,466	1,466	1,471	1,438	1,589
Licenses							
New Licences	398	207	247	181	181	185	231
Total Licences	1,112	1,305	1,532	1,440	1,403	1,390	1,492
Royalties (\$ millions)	6.9	12.0	15.7	16.3	15.5	15.1	15.2

Notes:

There was no survey in 1999-2000.

1. All figures for 2003-2004 and 2004-2005 are preliminary.

Sources:

Statistics Canada, 2005; Federal science expenditures and personnel 2006-2007; Intellectual property management, fiscal year 2004-2005. Science, Innovation and Electronic Information Division.

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10 Years of Leadership in Technology Transfer



During its first 10 years, FPTT members have played a key role in managing departmental technology transfer activities, and guiding intellectual property management and technology transfer policy development. Working with Industry Canada, FPTT helped introduce two landmark authorities:

- The first allowed government departments to retain 100% of the royalties from the licensing of technologies. Previously, technology transfer activities were financed solely by A-base funding. This new revenue helped many departments to expand their technology transfer activities.
- The second expanded the Award Plan for Inventors and Innovators Policy to innovators who contributed to an invention's commercialization, which improved the probability of its success.



As well, FPTT took an active role in the development of the Policy on Title to Intellectual Property Arising under Crown Procurement Contracts. Crown ownership of contractor intellectual property was no longer automatic, and contractors received far greater access to the intellectual property. FPTT however ensured that government departments retained control of intellectual property under certain critical conditions.

Active in many other areas important to its members, FPTT additionally

- Set up chapters in all regions, which bring experts to meetings and facilitate the sharing of best practices
- Organized numerous conferences, workshops and training sessions for FPTT members as well as the Canadian technology transfer community at large
- Published *A Technology Transfer Decision Framework for Publicly Funded Research Organizations* and *Guiding Principles for the Management of Intellectual Property Issues* and reports such as *Building Successful Commercialization Teams for Federal Labs* and *Incubating Technology: Best Practices*
- Established a website for Canada's technology transfer community, which includes a training inventory, directory of key resources worldwide and a list of all federal laboratories in Canada

- Developed its own community of practice
- Created the monthly *FPTT News*, which is distributed to more than 3,000 readers in the technology transfer community across Canada and the US
- Became a channel partner for Flintbox®, a bilingual web-based application that facilitates the marketing and licensing of the output of research from publicly funded organizations in Canada and the US
- Launched an R&D Impact Network, whose objective was to establish best practices for measuring the impact of R&D and technology transfer

Through its annual awards program, which is unique in Canada's technology transfer community, FPTT has recognized excellence in federal research organizations, their technology transfer activities, and the firms that have successfully commercialized government technologies. It publishes an annual report and designed a poster entitled "A Century of Innovation – Federal Labs at Work," of which more than 75,000 copies have been distributed to date.

As FPTT embarks on its next 10 years, our stakeholders can expect the best as we continue to promote model practices in technology transfer, foster the development of professional capacity in technology transfer and commercialization, and establish FPTT as a leader in intellectual property management and technology transfer issues.

Winning Technologies

FPTT has worked with many teams and individuals who have transferred a wide array of knowledge and technology. The subsequent exploitation of these technologies into successful commercial products has created jobs, generated wealth and enhanced the general well-being of Canadians.

The achievements of these individuals and teams are a testament to the broad impact of federal science and technology programs, and to the depth and breadth of scientific and technological talent in Canada. This retrospective pays tribute to the exemplary work of diverse departments, agencies and companies.



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SDR Makes Interoperability a Reality



As Hurricane Katrina illustrated in 2005, the breakdown of communications during a natural disaster can swiftly turn an emergency into a catastrophe.

The Software Defined Radio (SDR) system pioneered by Communications Research Centre Canada (CRC) provides reliable and uninterrupted communication between radios and other devices.

Imagine a radio technology that could configure a wireless device to work with any communications system: a cellular phone, a pager, an FM or AM radio, or a satellite communications terminal. This would offer both cost and time savings for consumers, who would only have to buy one radio to meet multiple communications needs. And, more important, that same technology could facilitate interoperability among the communications systems used by military, police and rescue teams, who cannot always communicate with each other, even sometimes in critical, life-threatening situations because of incompatible radio systems.

SDR works much like desktop computing, where a single hardware platform can carry out many functions based on the software applications loaded. SDR uses software to perform radio-signal processing functions instead of using resistors, capacitors, feedback loops, or application-specific integrated

circuits. Frequency tuning, filtering, synchronization, encoding and modulation are now performed in software on high-speed reprogrammable devices such as digital signal processors, field programmable logic arrays, or general purpose processors. RF components are still needed for generation of high frequencies or for signal amplification and radiation, but SDR aims at reducing the count to a minimum.

CRC played a key leadership role in the development of the SDR system, in collaboration with the US Department of Defense and an international forum of industry experts.

The CRC team offers on its website an open-source implementation of the SDR software architecture specifications as well as the design of a low-cost radio prototype, to be used as a catalyst for the development of more complex radio systems. A more elaborate version of the specifications, coupled with a complete suite of software development tools, has also been produced by the team and is available under licence. Since 2004, CRC has licensed its software suite to 16 companies, generating approximately \$600,000 in royalty revenue.

With ROBYS™ Both the Environment and Industry Win

More than 50% of the one billion litres of industrial and commercial oil sold each year in Canada is lost, incinerated or dumped into the environment – a sobering statistic, in that it takes only one litre of oil to contaminate one million litres of water.

Environment Canada's 4Rs – Reduce, Reuse, Recycle, and Recover – were taken to heart by researchers at Natural Resources Canada (NRCan). Recognizing the environmental and economic advantages to recovering rather than disposing of used waste oils, researchers at NRCan's CANMET Energy Technology Centre in Ottawa focused on ways to improve the stability and quality of reprocessed products obtained from wastes such as crankcase motor oil and industrial lubricants.

In particular, the team and its licensee, Par Excellence Development Inc. of Sudbury, sought a solution to the severe product quality problems inherent in a recycling process called 'thermal cracking,' which uses heat to break or 'crack' large oil molecules into smaller diesel-fuel molecules.

For years, small and medium used-oil recycling companies had been stymied by the challenges posed by the drawbacks of the process – a malodorous, unstable gas oil contaminated with acidic compounds.

The result of the collaborative effort was a solvent extraction technology called ROBYS™, a process

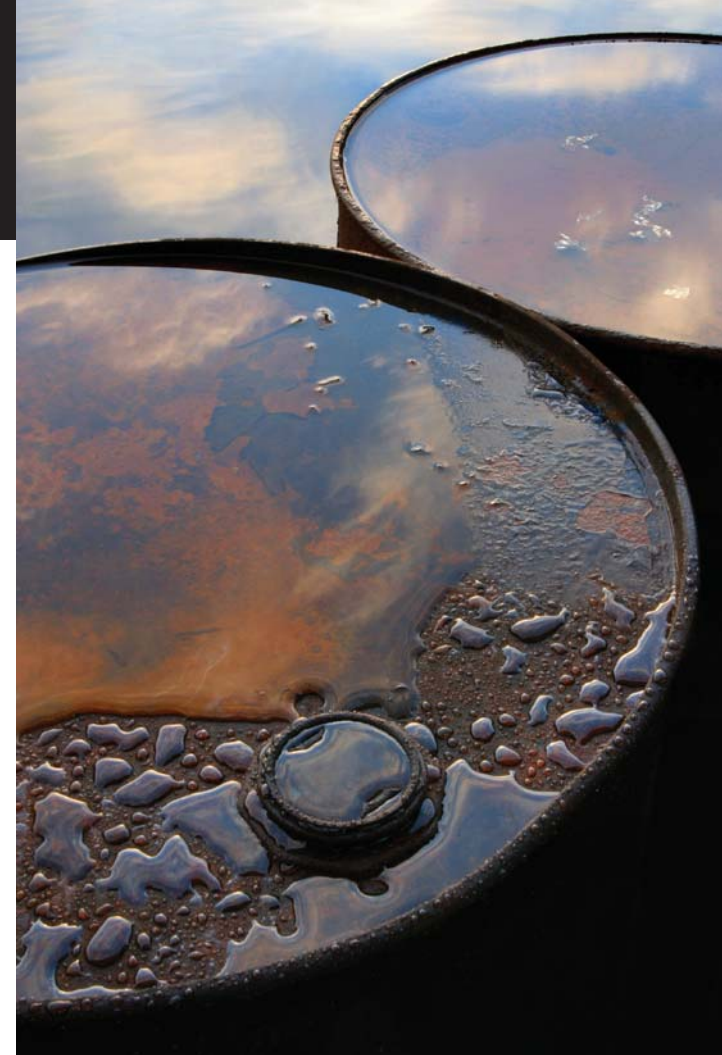
that effectively stabilizes and purifies thermally cracked waste fuels, reducing odours and dramatically increasing the recycled fuel's marketability.

The new technology benefits both the waste oil reprocessing industry and the environment. Life cycle studies of the ROBYS™ system reveal fewer greenhouse gas emissions in the production of diesel fuel derived from waste oil thermal cracking than the conventional diesel fuel production from crude oil. By maximizing the amount collected and reused, the technology also reduces the amount of waste oil that enters the environment as a pollutant.

The first world-scale commercial application of the ROBYS™ process was implemented at a Malaysian waste oil thermal cracking plant that can process more than 33 million litres of waste oil a year. That is equivalent to more than eight million oil changes for an average car. Other installations are planned in Belgium, Thailand, China and Libya.

"Canada needs initiatives like FPTT. If the laboratories of federal science-based departments and agencies are to exploit their full potential as national resources..., those of us responsible must strive to employ every tool available to us to transfer their expertise...to private industry, other institutions, and individuals in order to draw maximum benefits for Canada."

Arthur J Carty, President, National Research Council Canada, 2003





OSMOSEC Shows That Cranberries Are Not Just for Turkeys

For many, the word “cranberries” conjures up images of turkey dinners. For people in Manseau, a community near Quebec City, cranberries also mean jobs, economic growth, and a remarkable success story.

Familiar to people around the world for its distinctive taste and health benefits, the cranberry is easy to grow, a fact that has helped position Canada as the world’s second-largest producer after the United States, in a US \$2 billion market worldwide.

In the 1990s growth in capacity was stymied by a worldwide drop in the market for traditional cranberry products. To counter this drop, several new products were developed in the United States, notably dried cranberries. In an effort to capture some market share, Canadian producers began the search for an efficient way to dry cranberries, while preserving their taste and texture.

The answer lay in a process developed by Agriculture and Agri-Food Canada’s (AAFC) Food Research and Development Centre (FRDC): soak the cranberries in a concentrated sugar solution before hot-air conveyor drying. In effect, use osmosis to partially dehydrate the fruit while sweetening it to make it more palatable.

The water in the cranberries flows out into the sugar solution, greatly reducing the water “load” in the fruit, as well as the drying time. The sugar solution sweetens the cranberries, and protects them

from oxidizing and browning. The process, called OSMOSEC, had originally been developed for drying apricots, prunes and blueberries, but was proving adaptable to a variety of fruits.

FRDC next sought a partner to commercialize the technology. They selected Atoka Cranberries, who had built the first cranberry processing plant in Canada with them a few years earlier.

Armed with \$200,000 in R&D funds from AAFC’s Matching Investment Program, the team did the research that enabled the processing plant to be established in just two years.

The FRDC team is now on to their next challenge: adapting OSMOSEC to infuse cranberries with orange, strawberry and blueberry flavours. The cranberry is about to shed its turkey reputation forever.

“NRC congratulates FPTT for its 10 years of leadership within the Canadian federal government technology transfer system and looks forward to working with FPTT and its partners to grow both the profile and importance of commercialization.”

Pat Mortimer, Vice President, Technology and Industry Support, National Research Council Canada, and Chair, FPTT Advisory Council, 2006

HarvestWatch™ Speaks the Language of Apples

Learning to speak the language of apples is perhaps a quixotic goal for science, but this is exactly what a team from Nova Scotia accomplished. Together, scientists from Agriculture and Agri-Food Canada's (AAFC) Atlantic Food and Horticulture Research Centre and Satlantic Inc. developed HarvestWatch™, a technology that improves monitoring in a controlled atmosphere environment. Once picked, apples are stored in sealed rooms where oxygen is decreased, and carbon dioxide is increased. Fruit deteriorates in contact with oxygen; this low oxygen-high carbon dioxide mix therefore provides an additive-free way of preserving apples from tree to table.

The challenge was to determine the lowest acceptable level of oxygen, then maintain it. One answer lay in the phenomenon of chlorophyll fluorescence. When illuminated, fruits and vegetables with chlorophyll emit a low level of light energy called fluorescence. It was observed that fluorescence spiked at a certain level; in effect, the apples "shrieked." As the level of oxygen in the chamber increased, the apples returned to a "happier" fluorescence level.

The next hurdle for the AAFC team was to develop an industrial-strength monitoring technology. Enter Satlantic Inc. of Halifax, a company that excels at using light signals to measure and control a number of natural processes.

With financial assistance from NRC's Industrial Research Assistance Program and AAFC, Satlantic successfully developed the optics and electronics for this monitoring process, fine-tuned the fluorescence algorithms, and tested the system under practical conditions.

Results are satisfying for growers and consumers alike. With HarvestWatch™, spoilage is greatly reduced, and shelf life extended, and higher-quality fruit and vegetables are obtained, with no chemical additives.

The potential for commercial application is vast. Further experiments have shown that HarvestWatch™ can be applied to all apple cultivars, as well as other fruits and vegetables. Given that the state of Washington alone harvests six billion apples per year, that amounts to a lot of happy produce. Commercial trials are underway in six countries besides Canada, using produce ranging from kiwi fruit to lettuce. The export market of HarvestWatch™ systems is estimated at \$3 million annually.





MEND Combats Acidic Drainage in the Mining Industry

Transferring technology and disseminating knowledge to a global industry take vision, boldness, and superb organizational abilities – not to mention powers of persuasion. The Mine Environmental Neutral Drainage (MEND) team at Natural Resources Canada had these qualities in abundance when tackling the problem of acidic drainage, the largest environmental liability facing the mining industry. It is the result of sulphur-bearing minerals oxidizing and creating potentially damaging effluents. Acidic drainage affects all sectors of the industry: coal, precious metals, base metals, iron ore and uranium. Total Canadian liability is estimated at \$2 – \$5 billion, with total worldwide liability at US \$100 billion or more.

In 1989, provincial and federal governments and the Canadian mining industry formed the MEND consortium to combat acidic drainage. MEND's innovation lay in its large-scale, collaborative, multi-stakeholder approach, with more than 130 volunteers from all sectors on its technical committees. The Secretariat at Natural Resources Canada coordinated activities. Today, the program is cited as a model of cooperation in technology development, and is being emulated in Canada, the US and Australia.

Developing solutions was only part of the challenge. To disseminate the valuable information, workshops became the vehicle of choice: MEND sponsored

or co-sponsored workshops for more than 2700 participants. A MEND international conference provided the opportunity to showcase new knowledge to an additional 650 delegates.

The Secretariat has published more than 200 technical documents. The MEND Manual, released in 2001, summarized its work to provide practitioners with a single reference document. The MEND website provides updates on emerging technologies, research and activities within Canada and internationally.

The MEND program has changed the mining industry worldwide. Planning, operating and decommissioning costs associated with acidic drainage have dropped dramatically. Liability for acidic drainage for the Canadian industry has been reduced by an estimated \$340 million, for five companies alone. And Canada's place as a recognized leader in R&D on acidic drainage for the metal mining industry is assured. Most important, mines are now operated and decommissioned in an environmentally responsible manner, leaving behind a safe, healthy environment with an often beautiful terrain. This is perhaps MEND's greatest contribution.

FPA Keeps Canada's Cattle Disease-Free

Speedy detection and diagnosis are essential for stopping a disease's spread. Yet diagnosis often relies on expensive, time-consuming tests that prolong exposure and delay control of the disease.

A dedicated team at the Canadian Food Inspection Agency's Ottawa laboratory has devised the Fluorescence Polarization Assay (FPA), a 15-second test for detecting brucellosis in cattle. Known as "undulant fever" in humans, brucellosis lasts for months, inducing an intermittent fever and debilitating, flu-like symptoms.

Based on the principle that the smaller the molecule, the faster it rotates in solution, the test uses a fluorescent label to measure the time a molecule takes to rotate through a plane of polarized light. When antibodies attach themselves to the molecule

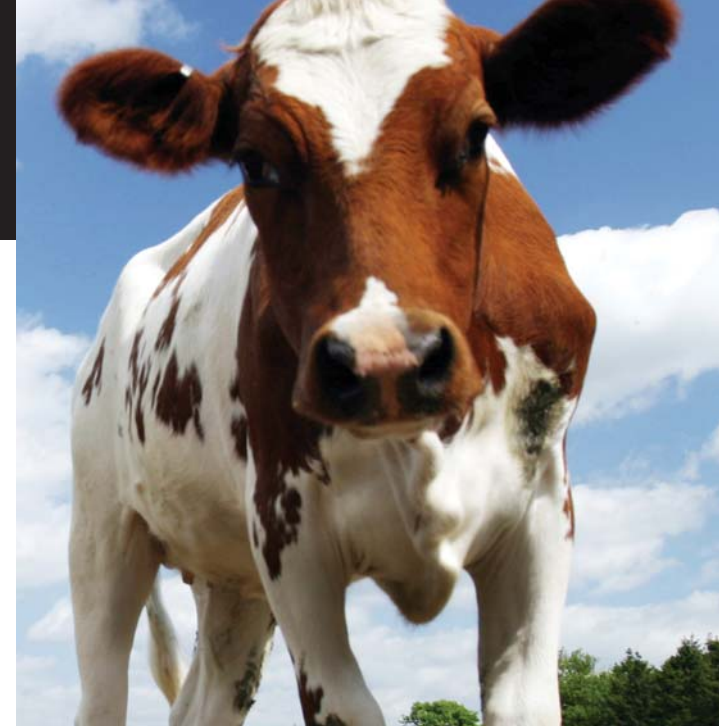
(making it larger), the molecule moves more slowly, indicating a positive result. An antibody-free molecule rotates faster, indicating a negative result.

The test is portable, simple, reliable, and does not require a laboratory. It is also stable under a variety of conditions, from +55° to -40° C. All this, at one-tenth the cost of some existing tests.

Canadian cattle have been officially brucellosis-free since 1984, but must be surveyed regularly because of the reservoir of disease in wildlife. Although the disease is under control here, it takes a major toll on people and animals in other parts of the world. In developing countries where dairy products from diseased animals are consumed, thousands of cases of human brucellosis still occur. In some parts of Latin America, as much as 25% of the population is afflicted.

"The widely diverse mandates in the federal S&T community have led member departments and agencies to adopt equally diverse Intellectual Property management practices to suit their specific needs and requirements. FPTT provides a platform for IP management integration among its members, and between its members and Canadian universities, who are key players in the Canadian innovation system. These efforts lead towards easier collaboration and a more effective commercialization of federally funded innovations."

Wendy Watson-Wright, Assistant Deputy Minister, Fisheries and Oceans Canada, 2006



The potential economic impact of an outbreak of such a disease is disquieting. Canada is a major exporter of animals, and our success rests on an ability to claim disease-free animals. Fortunately, FPA has been approved as the official brucellosis test in Canada.

Diachemix, an American company, manufactures and licenses FPA. Now the challenge is to decrease the unit cost of the equipment, to make it affordable to governments around the world.

To date, the test has been approved for use in the US, Mexico and Argentina, and is being evaluated for use in eight European countries.

VPAS Helps Canada Maintain Its Worldwide Grain Reputation 5,000 Kernels per Minute



In the world of R&D, persistence pays off. This was certainly the case with the commercialization team at the Lethbridge Research Centre of Agriculture and Agri-Food Canada, who negotiated the worldwide licence of its Visual Particle Analysis System (VPAS) technology with DuPont Canada Ltd.

VPAS is an artificial intelligence-driven, digital imaging, analysis technology that can instantly view and analyze the characteristics of thousands of tiny objects. Its first major application is Acurum™, a system that can objectively assess more than 340 specific characteristics of 10,000 kernels of grain, barley, and other seeds and commodities in less than two minutes. The Acurum™ decision engine was developed using actual seeds and Canadian Grain Commission grading factor definitions. Characteristics assessed include diseases, handling and environmental conditions, seed classification and determination of admixtures of seeds. Such information helps key suppliers in the grain producing value chain to make better business decisions in the grain quality assessment process.

Unlike human sorting, VPAS results are repeatable, not subject to transcription error, and blindingly fast. VPAS can be adapted to multiple uses – biological and others – simply by changing the parameters loaded into the operating system.

The power of VPAS is complemented by Internet-based services that allow for continuous system upgrades, quality control and product tracking. Information from various Acurum™ units is uploaded every evening into a central database. At the same time, information flows the other way, as upgrades are downloaded overnight. The result is a product tracking and information management system that continues to learn. Equally important, the result is a means by which Canada can dramatically enhance its ability to market agricultural and other products under very stringent specifications, guaranteeing high-quality, safe food products.

The sole worldwide licensing agreement was signed for the technology, plus one seed application, in May 2002. The agreement, which includes requirements for development and manufacturing of Acurum™ by Canadian companies, provides benefits to both Canada and DuPont.

CASCAD and Blast Guard Fight Terrorism

The Canadian Aqueous System for Chemical-biological Agent Decontamination (CASCAD)/Blast Guard technology exemplifies the merits of teamwork in fighting terrorism. Defence R&D Canada (DRDC), an agency of the Department of National Defence (DND), and the Royal Canadian Mounted Police (RCMP) created one of the world's most effective bomb mitigation and decontamination systems. CASCAD/Blast Guard was deployed as a precautionary measure at the Olympic Games in Sydney and Salt Lake City, as well as the 2001 inauguration of President George W Bush.

When asked to develop an environmentally friendly product to combat chemical and biological terrorism, DRDC-Suffield in Alberta began work on CASCAD, a water-based foam that neutralizes chemical and biological warfare agents and radiological contaminants.

Concurrently, the RCMP in Ottawa was developing Blast Guard to mitigate the effects of explosive devices such as pipe bombs containing anthrax, sarin or mustard. The system comprised a spreading foam, a dispensing nozzle and a small domed-shaped tent – flexible, yet strong enough to contain the fragments of detonated bombs.

The merging of the systems enhanced both. Improved by the Blast Guard dispensing system, CASCAD foam adheres to vertical surfaces such as the sides of vehicles and buildings. When placed over the explosive device and filled with CASCAD foam, the Blast Guard portable tent provides a controlled environment that buys time to evacuate before detonating the bomb and neutralizing toxic materials.

CASCAD/Blast Guard is a model of creative technology transfer. When cutbacks threatened the project in the 1990s, it became the first to receive funding under a Canada-US agreement to support counter-terrorism research and development. As development progressed, technology transfer professionals from DND, the RCMP and the National Research Council Canada focused on patenting various components and combining the two elements into one industrial package. Marketing of the technology was awarded to NBC Team Ltd. of Fort Erie, Ontario, who brought the product and a family of delivery systems to market.

Today, CASCAD/Blast Guard is marketed worldwide by Allen Vanguard, with sales of \$3 million, a projected annual revenue of \$10 million, and clients in the US, Australia, Austria, Denmark, Sweden and Korea.





RSDL Is the 21st Century's Noxzema®

When Canadian Armed Forces personnel were deployed to the Gulf War in 1991, they took with them the first bottles of Reactive Skin Decontaminant Lotion (RSDL), a revolutionary advance in the field of personal decontamination and protection against super-toxic materials. Researchers with Defence R&D Canada (DRDC), an agency of the Department of National Defence, had struggled for more than two decades to develop this skin decontaminant. It is powerful enough to protect Armed Forces personnel from deadly chemical warfare and biological agents, some of which can kill within minutes of skin contact.

The time required to develop RSDL reflects the difficulties encountered, and the complexities of the problem it addressed. Because of the large variety

and extreme toxicity of chemical warfare agents, the lotion had to be versatile, effective under varied field conditions, yet benign enough to use on skin, in and around the eyes, and safe if carried into wounds. The devastating speed of certain chemical agents meant that pouches and foam applicators had to be tailored for individual use, for battle conditions allow no time to evacuate victims to medical facilities. The lotion not only met, but exceeded, those requirements.

By 1995, RSDL was ready to be commercialized. Even then, there were challenges to overcome. O'Dell Engineering Ltd., a Cambridge Ontario-based company established specifically to produce and market the lotion, spent another five years transforming a laboratory technology to an industrial

setting, and refining the active molecules and the applicator delivery system to pass rigorous regulatory reviews and repeatability trials.

Marketing such a breakthrough decontaminant was perhaps the easiest phase of the commercialization. RSDL was described by an American magazine in 1999 as the "Noxzema® for the next century." The product was ranked by the US Navy as its first priority for acquisition under the Foreign Comparative Test program, and was purchased by the Australian Army for the Sydney Olympics 2000. O'Dell subsequently assigned the licence to E-Z-EM Incorporated in early 2005.



Oncentra® Incorporates the Gold Standard for Radiotherapy Treatment

The partnership between the National Research Council Canada (NRC) and MDS Nordion was a perfect match. NRC's Institute for National Measurement Standards (NRC-INMS), a world leader in the field of radiation therapy dosimetry, was seeking a Canadian company to commercialize its adaptation of the Monte Carlo simulation technique. Monte Carlo methods are a widely used class of computational algorithms for simulating the behaviour of various physical and mathematical systems. The NRC-INMS technique significantly improves the speed and accuracy of radiation therapy treatment planning for cancer patients. MDS Nordion, well positioned to market the technology worldwide, was eager to enhance its product line of leading-edge therapy systems with the NRC-INMS technology.

Dr Arthur J Carty, NRC President at the time, said, "We are especially pleased that this long-term investment in basic research has led to such a breakthrough. Not only will the application of the research result in economic benefits for NRC and MDS Nordion – and help fuel economic growth in Canada – it will greatly enhance the speed and

accuracy of radiation therapy, help doctors provide better health care and help ease treatments for cancer patients."

In July 2002, MDS Nordion received approval from the US Food and Drug Administration and Health Canada for its Oncentra® Treatment Planning software, which incorporated the Monte Carlo electron dose calculation algorithms. This established the Monte Carlo software as the "gold standard" for dose calculation accuracy in radiotherapy treatment for cancer patients. Sales of systems incorporating the Monte Carlo software were expected to generate more than \$10 million in the first five years.

In February 2003, Nucletron® BV, one of the world's leading providers of radiotherapy equipment, acquired the MDS Nordion oncology software portfolio and the intellectual property represented in the software. NRC-INMS metrology research continues to benefit from the licensing of the Monte Carlo code through funding to support new research activities.

"The FPTT workshop on structuring technology transfer offices was instrumental in helping us align our business development offices."

George H. Kimbell, Acting Chief, Research and Development, Department of National Defence, 1997





MAP™ Extraction Technology Reaps Profits while Helping the Environment

Environment Canada's Microwave-Assisted Processes (MAP™) technology uses microwaves to enhance and accelerate biological, chemical and physical processes. The technology was initially developed at Agriculture and Agri-Food Canada by Dr Jocelyn Paré to extract natural products such as floral and flavouring essences. In 1989, Dr Paré joined Environment Canada, where the technology was further developed and all the technology transfer activities were carried out. Dr Paré received the 2001 FPTT Innovator Award for realizing the multiple possibilities of MAP™ and for helping to make it a scientific, economic and environmental success. Under his leadership, MAP™-related techniques have expanded into a host of pat-

ented, environmentally friendly applications, and are gaining broader acceptance in the research, industrial and commercial sectors.

MAP™ uses microwaves and solvents, which are relatively transparent to microwaves, to extract chemicals from various substances. The applications of the technology include rapid sample preparation methods for the analytical laboratory and cost-effective replacement methods for conventional industrial extraction processes. When compared with conventional methods, MAP™ reduces production time, energy, solvent consumption and waste production – cutting both greenhouse gas emissions as well as waste disposal costs – while increasing extraction yields and extract purity.

Regarded as one of the most effective technology development and transfer programs to originate in a government laboratory, MAP™ is used worldwide, with projected economic spin-off from the technology expected to reach an estimated \$200 million within

five years of introduction. MAP™'s success in the Canadian canola industry illustrates its wide-ranging economic value. Between 1992 and 1994, the industry lost significant ground in international markets, with the value of exported canola oil increasing by only 90 per cent, compared to the soaring value of imports to Canada by 763 per cent. Under Dr Paré's leadership, a \$7.9-million project was initiated to demonstrate MAP™'s effectiveness for industrial canola processing. With MAP™, the industry was able to achieve more energy-efficient processing of raw materials, and offer more competitive pricing, while creating the potential to significantly reduce the environmental footprint of this industrial activity.

With MAP™, Dr Paré has achieved an enviable record of serving the public good and providing Canada's industrial sector with tools that enhance its competitiveness, all while supporting sustainable development.

"NRCan is looking at how best to contribute to the government's renewed emphasis on commercialization. The importance of transferring the technology developed in federal laboratories to the private sector to be commercialized and marketed cannot be over-emphasized."

Yvan Hardy, Chief Scientist, Natural Resources Canada, 2006

IQT™ Offers Accurate, Automated Diesel Fuel Testing

Often the best ideas begin small and blossom into something large. With the initial goal of improving a manually operated research instrument for use with fuels derived from oil sands, researchers from the Canada Centre for Mineral and Energy Technology (CANMET) of Natural Resources Canada and the National Centre for Upgrading Technology collaborated with engineers from Advanced Engine Technology Ltd. Eventually their collaboration resulted in a much broader success: the IQT™, a diesel fuel Ignition Quality Tester with an associated test method.

Standard petroleum fuels must meet certain standards before being sold, among them a minimum cetane number (CN), which indicates how well the fuel performs in an engine. Measuring CN is time-consuming, and test results are difficult to reproduce. The relationship of test engine performance to full-scale, variable-speed, variable-load engines is not completely understood. Further, results are accurate only to ± 2 CN, resulting in refineries usually exceeding the minimum CN to be safe.

In production environments, ignition quality of diesel fuel is estimated by a cetane index, derived from the properties of conventional petroleum fuels and difficult to apply to other fuels. Recognizing the potential of the technology, and that a single test should be available for all fuels on the North American

market, the team expanded the project scope to cover a wide range of distillates and alternative fuels as well as cetane-improver additives.

The IQT™ was launched, coinciding with an increasing worldwide demand for environmentally friendly fuels and the emergence of alternative fuels. Now refineries have a 20-minute, accurate, automated measurement alternative to the cetane engine. IQT™ is sensitive to cetane-improver additives and to small

fuel quality variations. It enhances understanding of the effects of fuel properties and composition on ignition characteristics. It also measures ignition delay of a wide range of middle distillate fuels over the entire CN scale. (Ignition delay is defined as the time between the injection of fuel and its ignition, a controlled reaction in a diesel engine that occurs when the fuel is mixed with a constant volume of air and compressed by a piston until it ignites.)



MVP™'s Free-Fall Fish Accelerate Deep-Water Data Collection

The Moving Vessel Profiler™ (MVP™) is a multi-purpose instrument that aids the collection of both shallow- and deep-water data sets. It comprises a computer-controlled smart winch system that deploys a multi-sensor “free-fall fish” while the vessel is underway, without affecting the speed or course of the ship. The system is completely autonomous and can be controlled by computer without personnel on deck.

Before MVP™, research vessels conducting tests at sea had to stop, lower sensors overboard, then retrieve them before continuing on course. The expensive and time-consuming data collection procedure often took two weeks or more. The Moving Vessel Profiler™ was developed by the Bedford Institute of Oceanography of Fisheries and Oceans Canada, and licensed to Brooke Ocean Technology Ltd. in Dartmouth, Nova Scotia. The instrument

saves a minimum of three hours per day of ship time by eliminating the requirement to stop and use a static cast. The sophisticated technology enables ships to collect the same quality of samples while underway at full speed, reducing a typical cruise to three or four days at a significantly lower cost.

The successful transfer of technology has added to the Bedford Institute of Oceanography's impressive list of innovative accomplishments and created new jobs for a flourishing business. Since its involvement in the construction and testing of the project, Brooke Ocean Technology Ltd., once a small firm of eight employees, has expanded significantly by hiring mechanical engineers, technologists, an electrical engineer and a programmer. In the early stages, the Bedford Institute designed and developed the control system and supervised the sea trials and final modifications while training Brooke's staff on the system's installation and operation. As a result of the technology transfer process, the Dartmouth engineering firm has acquired the mechanical, electronic and programming expertise to produce commercial versions of the system and to continue developing versions capable of profiling even greater depths.



Space-Time Acoustic Scintillation Revolutionizes Measurement of Water Properties

Perseverance, resourcefulness and patience are three virtues that often turn a simple act of faith into a successful transfer of technology. Dr David Farmer, a research scientist with Fisheries and Oceans Canada (DFO) in Sidney, British Columbia, and ASL Environmental Sciences Ltd., displayed an abundance of all three in their decade-long quest to bring a breakthrough procedure into widespread commercial use. Designed for tough flow measurement such as hydro-electric turbine discharge in low-head, short-intake power plants, the method is known as space-time acoustic scintillation. It exploits the way in which sound pulses transmitted from one point and measured at other points are modified by natural variability in the water. Theoretical techniques are available to enable inversion of the results so as

"FPTT is a very effective mechanism for ensuring that technology transfer activities are not reinvented in every science-based department and agency. It provides a forum for the right people to talk to each other, and saves time and money."

Jacques Lyrette, Vice-President,
National Research Council Canada,
and Chairman, FPTT Advisory Council 2001

to provide accurate measurement of water properties such as currents, temperature variability and turbulence. The technique has an impressive range of applications that span the measurement of ocean currents to the load tuning of turbines for improving efficiency of hydroelectric energy production.

Early versions of the instrument generated massive data sets, requiring tape changes at 10-minute intervals day and night, and enormous processing efforts. Funding from the Canadian Panel of Energy Research & Development, with support from the US Office of Naval Research, enabled ASL, the BC-based manufacturer and licensee, to implement powerful real-time signal processing using a novel hard-wired correlator engine developed especially for the purpose. Since then, the system has been refined, and the range of potential applications greatly increased. ASL has now implemented the technology for DFO in a variety of coastal environments. With a US company, ASL developed a battery-powered version that was successfully used in the Black Sea in Turkey. Another contract led to provision of real-time navigation information in Vancouver Harbour. Prominent customers in the hydroelectric field include the US Army Corps of Engineers and the Tennessee Valley Authority. Most sales are to the US market, with the superiority of this technique over competing methods now recognized by both Canadian and American utilities.





Fibre Bragg Gratings Fill CRC's Patent Treasure Chest

In 1998, Communications Research Centre Canada (CRC) received an FPTT award for its technology transfer to Innovative Fibers, a spin-off company of CRC that commercialized a technology known as Fibre Bragg Gratings (FBGs). That company grew from a two-person start-up based out of a garage on CRC's campus to an integrated manufacturing operation employing 400 people in Gatineau, Quebec when it was purchased by Alcatel Optronics in 2000.

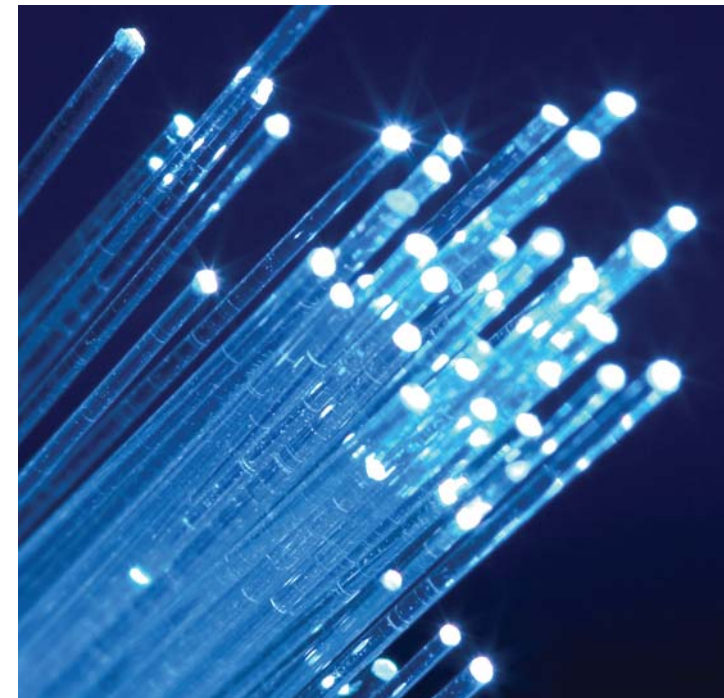
Along with Innovative Fibers, 10 other Canadian companies have exploited the technology under licence since 1994, dominating the market segment for this product worldwide by supplying more than 50 percent of the global demand.

Recognized by the IEEE as one of the four greatest milestones in optical engineering, the use of optical FBGs in commercial products has grown exponentially in telecommunications, where their introduction has facilitated the implementation of high-speed networks, and in engineering applications as stress sensors and strain gauges.

Concurrent research and development by CRC and United Technologies Corporation (UTC) of East Hartford, Connecticut on methods of fabricating various designs of Bragg gratings resulted in this US company obtaining a number of patents worldwide. Given the relatedness of the patents, CRC and UTC entered a cross-licence to bundle the patent rights into a joint portfolio for commercial exploitation through licensing. Since 1994 the technology has been licensed to more than 30 companies worldwide. The licensing program has earned approximately \$10 million for CRC since 1994.

Exploitation of the technology by CRC and its partner was nearly blocked in 1998 when ownership of a key patent in the portfolio, CRC's

Phase Mask, was challenged before the US Patent and Trade Mark Office by two giant multinationals, Corning Corporation and Furukawa. The case was fought largely over the issue of which party was first to invent, and took four years to resolve. CRC eventually prevailed in a decision that was rendered by the US Patent Office Tribunal in August 2002. Despite spending approximately \$1 million on the legal defence, CRC was vindicated and continues to exploit its IP rights today.



Thin Film Technology Continues to Expand into New Applications and New Markets

The world-leading research in thin film technology by the National Research Council Canada's Institute for Microstructural Sciences (NRC-IMS) has resulted in a wealth of patents and proprietary know-how. Some of this technology was transferred in 1998 to a spin-off company, Iridian Spectral Technologies, for use in the manufacturing of telecom filters. In addition, other thin film projects resulted in the development of an anti-counterfeiting device based on the use of optical coatings (currently used in Canadian bank notes and other products), and in collaborative work with Shincron Co., Ltd. to develop leading deposition equipment.

Iridian initially licensed NRC technologies and has continued to add to its Intellectual Property portfolio, devoting over 15% of its resources to R&D. Iridian has ongoing interactions with the IMS Thin Films Group, as well as a continuing commercial relationship with Shincron. The company began with products related to fibre-optic communications with the focus

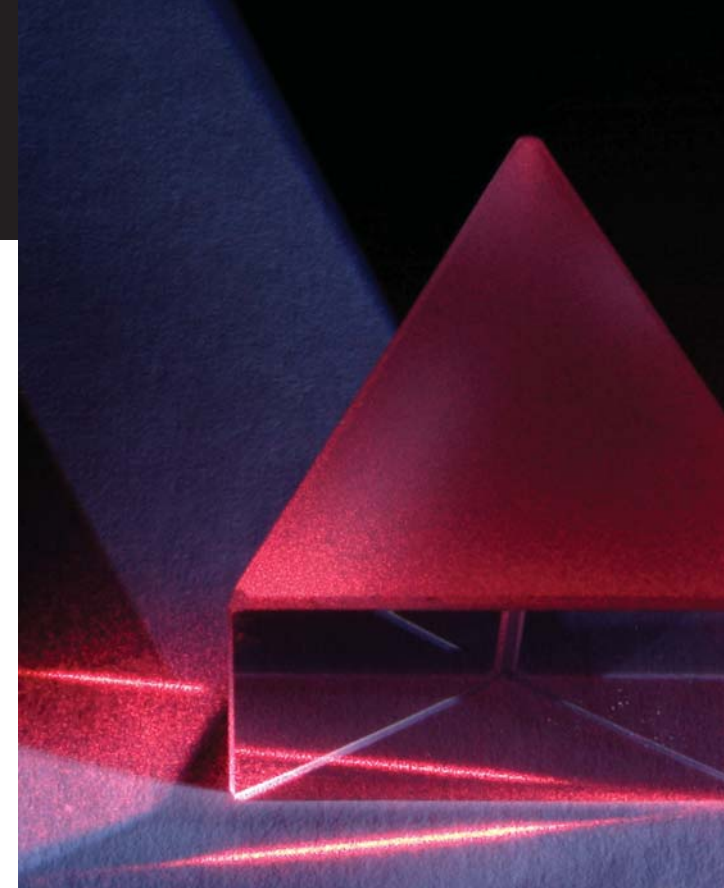
on some locally based customers. Today, its products span applications as varied as telecom filters, Raman spectroscopy filters, fibre-optic sensors, micro-optics, biophotonics, instrumentation optics and space applications. The markets are now almost entirely export and global in nature with a strong emphasis on Asia (China, Korea, Japan). Iridian has an international reputation for the manufacture of dielectric thin film filters of high complexity and quality.

Iridian is a Canadian-owned private corporation. The company is highly automated and currently employs over 40 people with a high percentage of technical staff. Over 250 person-years of employment have been directly created by the company to date and many more indirectly through the use of local Canadian suppliers. Revenue growth has averaged about 40% per year for the last three years.

Iridian benefits from occupancy of technical staff within NRC's Industrial Partnership Facility, which

"Relationships are at the very heart of our technology transfer activities. By sharing our experiences and networks, our institutes are witness to a growing and vibrant new entrepreneurial culture. More and more, we are working together within the federal government to better meet the needs of our clients."

Brian Morrissey, Assistant Deputy Minister, Research Branch, Agriculture and Agri-Food Canada, and Member, FPTT Advisory Council, 1997



supports the ongoing collaborative research and development activities between the company and NRC. In addition, financial returns have enabled NRC-IMS to renew part of its capital infrastructure.

Commenting on the relationship between NRC-IMS and Iridian, Iridian Chairman PH Dawson said, "We have very direct linkages with NRC and the Institute for Microstructural Sciences. That's a very attractive feature for the development of new technology. We occupy Industry Partnership space and NRC provides us with a stimulating technological environment for our staff, which helps in recruitment and retention."

NeisVac-C® Combats Meningitis around the World

A few years ago, approximately 10% of Canadians who contracted meningitis died soon after catching the disease. Many of those who survived suffered serious health complications such as permanent brain damage, deafness and mental deficit. And two-thirds of these patients were children under the age of five.

In response, the National Research Council Canada's Institute for Biological Sciences (NRC-IBS) developed

a vaccine for Group C meningococcal disease (NeisVac-C®) that is currently being marketed in Canada by GlaxoSmithKline.

The meningococcal Group C vaccine is the culmination of decades-long laboratory research and investments to eradicate this often-deadly disease. NRC-IBS' Dr Harold Jennings, the principal researcher for the project, began looking for a way to fight meningitis as early as the 1970s. After

many years of research and obstacles, persistence paid off and the team's work has resulted in a highly effective, very safe, and easily administered vaccine that has the potential impact of saving literally millions of lives around the world. The vaccine's capacity to effectively protect very young children—the group hardest hit by Meningitis-C—sets NeisVac-C® apart from traditional vaccines that have been used in North America.

The vaccine was first approved for commercialization in Canada in 2002. This follows a successful UK immunization program, through Baxter International, where the launch of the vaccine resulted in sales of \$86 million Canadian in the first year alone. As a result of more than \$500 million in total sales, approximately \$20 million has been paid to NRC-IBS through its licensing agreement (the largest ever paid to NRC), which has been reinvested in Canadian research.

Dr Jennings emphasizes the national benefits and economic gains resulting from this work. "By investing the funds received from vaccine sales back into vaccine research, we are working on expanding the applications of our knowledge to other devastating diseases such as cancer."



LEDs Make Level Crossings Safer

Highway-railway crossings present a significant hazard to drivers, resulting in approximately 300 accidents and 50 fatalities per year in Canada. Signal lights activated by the approach of a train are the most important component of crossing warning systems. Traffic lights and highway-railway grade crossing signals serve the same function in stopping traffic, but the technology behind each is very different. While both use incandescent lights, grade crossing signals must be able to run from a backup battery for a considerable period in the event of a power outage. Consequently, to conserve power, railway lights use only 18-watt bulbs instead of the 150-watt bulbs used in traffic lights. To get sufficient

light intensity, mirrors and lenses are used to create a focused beam directed at the motorist. This requires not only precise alignment of the light bulbs, but a substantial structure to hold them firmly in place as well.

To resolve these challenges, the Transportation Development Centre of Transport Canada developed a light-emitting diode (LED) technology that raised the performance of highway-railway crossing lights to the same level as high-speed, wide-angle traffic signal lights. The improvement increases driver safety, for LED signals are more conspicuous to the human eye. LED signals can turn on and off instantaneously (provided that the power supply remains constant), which improves the range at which flashing lights can be seen. LED technology available today outperforms existing incandescent technology. LEDs produce a far more conspicuous signal with a broader beam that is less susceptible to misalignment, thus providing a safer highway-rail grade crossing.

About 20,000 LED lights are currently in use at grade crossings in the US. Following adoption of an appropriate LED standard, Transport Canada is now deploying LEDs at level crossings nationwide.

"FPTT has played a key role in helping DND forge stronger associations with customers and partners. For instance, workshops organized and hosted by FPTT have provided opportunities to exchange best technology transfer practices and build networks both within FPTT and with other organizations."

John Leggat, Chief, Research and Development,
Department of National Defence,
and Member, FPTT Advisory Council, 1999





DNA Tracking System Helps to Make Communities Safer

DNA analysis is the most powerful tool for human identification since the use of fingerprints was pioneered more than a century ago. Now, thanks to a joint effort by the Royal Canadian Mounted Police (RCMP) and Anjura Technology Corporation, the Convicted Offender Index of the National DNA Databank (NDDDB) now contains over 108,000 DNA profiles and the Crime Scene Index over 33,000 profiles.

The DNA Sample Tracking and Control System (STaCS™) was designed and developed by a team of scientists from the RCMP's Forensic Laboratory Services in partnership with developers from Anjura. The STaCS™ software enables law enforcement agencies to quickly and accurately analyze and store DNA samples. It manages the entry, history and continuity of samples throughout the analytical process to ensure integrity of the samples and the privacy of the sample donor.

The Illinois State Police were the first to purchase a STaCS™ licence in 2004, followed two years later by the California Department of Justice and the Michigan State Police. The sale of the first licence was negotiated by the Illinois State Police and Anjura with the input of the RCMP's Intellectual Property Office (IPO). The IPO protects, regulates and, where appropriate, commercializes the intellectual property of the RCMP.

"The RCMP's national DNA data bank provides a key investigative resource for all Canadian law enforcement partners," said then RCMP Commissioner Giuliano Zaccardelli. "Extending this RCMP technology to another law enforcement agency is a further demonstration of our commitment to [an] integrated approach to policing."

"We are proud of this system and will re-invest a percentage of the royalties into further research and development in the field of DNA profiling," commented Joe Buckle, Assistant Commissioner of Forensic Science and Identification Services.

The RCMP is committed to working with law enforcement agencies to help investigators increase their ability to solve crime. Sharing this new technology is another way to ensure that the best forensic tools are available. With each advance in technology, law enforcement gets a better tool to solve crimes. Every crime solved helps to make Canadian homes and communities safer.