



Communications
Research Centre
Canada

An Agency of
Industry Canada

Centre de recherches
sur les communications
Canada

Un organisme
d'Industrie Canada

Technology Transfer and Commercialization at Communications Research Centre Canada (CRC)

**Presentation to the Ontario Commercialization Network (OCN)
and Federal Government Laboratories**

December 12, 2006

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Presentation Outline

- CRC's Mandate
- Key Objectives for Technology Transfer
- Major Activities and Outputs
 - IP Protection and Management
 - IP Transfer/commercialization
 - IP Administration
- Comparison with U.S. R&D Labs
- Economic Impact of Technology Transfer from CRC
- Success Factors
- Shortcomings/Gaps/Things we like to do

CRC's Mandate

- To be the federal government's centre of excellence for communications R&D, ensuring an independent source of advice for public policy purposes.
- To help identify and close the innovation gaps in Canada's communications sector by:
 - engaging in industry partnerships;
 - building technical intelligence;
 - supporting small and medium-sized high technology enterprises.

Key Objectives for Technology Transfer

- Maximize technology transfer to industry for commercialization.
- Transfer technology to industry through licensing, collaboration, service agreements and using innovation centre.
- Protect, streamline, and exploit our patent portfolio through IP analysis and evaluation, IP target marketing, IP monitoring, enforcement, defense and strategic alliances with outside organizations.
- Develop and cultivate collaborative relationships with industry and other partners, through Government R&D funding programs including IRAP, CIDA, and OCN (?) and leverage these programs for commercialization of CRC technologies.
- Act in a business like manner and be responsive to client needs and minimize bureaucratic procedures to the extent possible.
- Maintain highest professional standards of service delivery to both internal CRC and external private and public sector clients.

Major Activities and Outputs

- IP protection and management
- IP Transfer / Commercialization
- IP administration

IP Protection and Management

Available Tools

Patents, Copyright, Trade secret, Trademark

Nature of our Activities

- Invention disclosure (Form A)
- Assessment of patentability – technical (prior art, novelty, non-obviousness) and commercial potential through invention of screening committee
- Contact patent agent, co-ordinate the preparation of application and file – both provisional and formal
- Office actions
- Patent maintenance
- Payment of government and other fees
- Maintenance of manual and computerized records

Patent Agents

- Neil and McLain Associates (Optical communications, broadcasting)
- Freedman and Associates (mainly advanced antennas but also others)
- Pascal (mainly optical)
- Borden, Ladner, Gervais (Mainly FEC – advanced turbo, viterbi etc)
- Gowlings (Block Equalizer)
- Thomas Adams (Satellite technology)

Magnitude of Activities

- 235 active patents
- 109 distinct technologies
- 10-15 new patent filings per year
- 0-5 trademark per year
- 40 - 50 office actions
- 15-20 abandonments

Some of the areas covered through recent filings

- Digital video compression and other techniques
- Hypercodes, and turbo and viterbi decoding
- Milton
- Optical technologies
 - Use of femtosecond lasers for FBG's
 - High temperature sensors using femtosecond FBG's
 - Packaging techniques for planar light wave circuits
- Advanced antennas
- MMIC RF technologies
- Speech estimation technique
- Frequency hopping technique and decoder
- 2D-to-3D image conversion

Defending our patents - to protect our licensees

- Phase Mask Patent Interference
 - First government lab to defend and win a patent against two major multinationals
 - Three party interference - Corning, Lucent and CRC
 - Declaration of Interference – Feb. 1999
 - 4 years and \$1 million

IP Commercialization

Licensing, R&D Collaboration and Other Agreements

Active Agreements:

Financial Agreements		395
License Agreements	336	
Collaborative Agreements	59	
Non-Financial Agreements (MOU's, MOA's, NDA's, Collaborative)		123
Total active agreements		518

New agreements (Typically over one year):

Licenses		44
Collaborative R&D		42
MOU, MOA...		9
NDA's		22
CRC Innovation Centre Agreements		8
Total New Agreements		125

A partial list of Canadian companies benefiting from tech transfer

Advantech	Genum	PMC Sierra
Aerosystems	Harris	Redline Communications
Algolith	ICS	Remec Nanowave
Array Systems Computing	Innovative Fibres (Alcatel)	RIM
Avendo Wireless	IP Unwired	Skywave
Avensys	ISR	Spectrum Signal Processing
BC Hydro	ITF Optical	Square Peg
Canadian Marconi	JDS	Telemus
CBC	LxSix	Telesat
Clearnet	Miranda	TerAxion
Comdev	MPB	Til-Tek Antenna
Data Radio Inc	Narrowband	Triumph Solutions Inc
EMS	Nortel	Ultra Electronics
Emscan	O/E Land Inc	

A partial list of international partners

3 M	Furakawa	Phillips
Alcatel	Gov't of Taiwan	R&S, Germany
C-DOT, India	Highwave	Showa Electric
Cienna	Kaist, Korea	Sumitomo
Comtech	Lucent	T&S Communications, China
Corning	Luna Innovations	Tadiran
Dolby	Mitre	Teracom
ETRI	NEC	Waveconcepts
France Telecom	Neilson Media Research	Weatherford

A partial list of technologies transferred

Turbo, viterbi codes
Fibre Bragg gratings
Modem technology
Radio propagation prediction
Objective audio quality
SDR/SCARI
Bus safety device
Optical couplers

Planar antennas
Web terminal / MILTON
Voice compression
Block equalization
Digital video processing
Spectrum Explorer
Linear amplifier technology

Revenue Generation

- CRC annually generates \$2-5 Million
- \$2.7 million earned in 2005-06
- 2002 was the best year – just after peak of telecom boom

IP Rev	\$4.1 Million
Collaborative R&D	\$1.1 Million
Total	\$5.2 Million

Technology Transfer Mechanisms

- Licensing
- Collaborative R&D or Service Agreements
- CRC Innovation Centre (incubation of telecom start-ups)

Licensing

- Nature of license grant: Maximizing use of technology & flexibility
 - Exclusive, worldwide, all fields of use
 - Sole (Emscan, Predict source code, linear amplifier)
 - Sole minus 1 (Hypercodes)
 - Non - exclusive (FBG)
 - Licensed products (sole minus1 for chip implementation and non-exclusive for software implementatin for PC's)
 - geographical-based (exclusive minus 1 in the US)
 - Field of use (Predict - communications v.s. broadcasting)
 - time-based (exclusive for one year)
 - source code / executable code (Predict)
 - whatever makes business sense

Licensing

- Licensing fees and royalties
 - Fully paid up-front license fee (CRC-Covlab, CRC-Predict, interleaving, etc)
 - Licensing fees spread over time, over number of products sold or revenues
 - Royalties - generally as a percentage of sales revenue but also some per unit pricing, sliding scale - generally decreased royalties based on volume
 - share of unit sale price or fixed number, whichever is less
 - Minimum Annual Royalties (MARs)
 - Capped limit on license fees and royalties (\$1 million for example)
 - Indemnification for infringing third party IP

Collaboration and Service Agreements

(mostly with private industry)

- SOW
- Milestones
- Deliverables
- Payments
- IP ownership
- Background and Foreground IP
- IP protection
- IP exploitation

IP Administration

Use of Intellectual Property Information System

License Agreements

- 336 active License Agreements
 - Commercial Licenses
 - Optional licenses
 - Letter agreements
 - Cross-license agreements
 - License amendments
 - License assignments

Use of IPIS

License Agreements (cont'd)

- Information Stored:
 - Type of license
 - exclusive, sole, sole minus 1, non-exclusive, etc.
 - Territory, Field of use
 - License fees
 - Upfront
 - Spread over a period of time
 - Royalties, MAR's
 - Royalty Reports
 - Expiry dates
 - Obligations at termination
 - Optional licenses – due dates
 - Linkages to other IP information
 - Electronic image

Use of IPIS

Collaboration Agreements, Service Agreements

- Typically with the private sector
- Information stored:
 - Milestones - dates, BF's
 - Deliverables
 - IP ownership
 - IP protection
 - IP exploitation
 - Invoicing information
 - Termination date
 - Amendments
 - Electronic image

Use of IPIS

MOU'S, MOA'S, Research Collaborations

- Research collaborations are mostly with universities for the generation of IP
- Information stored:
 - SOW and respective obligations
 - Termination date
 - IP ownership
 - IP protection
 - IP commercialization
 - Background and foreground IP
 - Linkages to other IP information
 - Electronic image

Use of IPIS

Patents

- Over 235 Patents
- Information stored
 - Form A (PSIA)
 - Provisional applications
 - Formal applications and patents
 - Divisional, CIP
 - US, Canada, EPO, PCT, Other countries
 - Invoices, fees
 - Deadlines
 - Filing deadlines
 - Examination deadlines (Canada for example)
 - Office actions deadlines
 - Maintenance fees
 - Trademarks
 - Copyrights

Use of IPIS

IP Award Program Administration

- Award calculations
- Inventor award statements
- IP Awards
- Contracting-in Award for IP transfer
- President Award for scientific collaboration
- Scanned agreements (in Word)

Use of IPIS

Reports

- Quarterly and annual reports
- Patent reports
- Other customized reports

Contacts

- Licensees
- Collaborators
- Internal inventors
- Patent agents
- Contracting - in companies

Meeting International S&T Agenda

CIDA/MILTON Projects (and China)

\$1.2 Million allocated by CIDA - most funding spent for technology development

Collaborative Projects:

- Planar antennas: 1.5 Ghz (rural telephony), 1.9 Ghz (Dect) and 2.5 Ghz Mobile satellite terminal
- MMIC Chips – LNA, Direct Modulator and Demodulator
- 6 W-CDMA / VLSI / FPGA / ASIC designs – Rake receiver, viterbi decoder, Root Raised Cosine FIR filters, and matched FIR filters
- 155 Mbps Direct Satellite Radio Terminal
- Licensed one technology already
- 30-35 engineers from CDOT visited CRC during the project

Current collaboration with CDOT

- Milton Field Trials
- Development of Wimax (802.16) / Milton system
- Licenses in China

Comparison with U.S. R&D Labs

IP Revenues¹ Normalized to R&D Budget² for Major Federal Labs in North America FY 2001/2002



IP Revenues Normalized to R&D Budget for Major Federal Labs in North America - 2001/2002 (This is the latest year for which statistics are available for U.S. labs)

	Licensing Revenues ¹ (thousands of dollars)	R&D Budget ² (millions of dollars)	Licensing Revenues normalized to R&D Budget (%)
Canadian Agencies			
Agriculture and Agrifood Canada	3548	289	1.2277
Canadian Food Inspection Agency	15	239	0.0063
Communications Research Centre	4058	34	11.9353
Department of Fisheries and Oceans	406	122	0.3328
Canadian Space Agency	68	314	0.0217
Department of National Defense	2221	269	0.8257
Environment Canada	502	200	0.2510
Health Canada	55	97	0.0567
Natural Resources Canada	1211	320	0.3784
National Research Council	4200	561	0.7487
U.S. Agencies			
Agriculture Research Service	2622	968.7	0.2707
Air Force	99	13745.6	0.0007
Army	845.5	5310.7	0.0159
Department of Energy	21387.5	6793.5	0.3148
National Aeronautics and Space Administration	1971.2	9602.4	0.0205
National Institute of Health	46100	17870.4	0.2580
Navy	1245.6	8748.6	0.0142
National Oceanic and Atmospheric Administration	1.5	591.2	0.0003
United States Geological Survey	220	553.8	0.0397

1. Canadian Data Source: Statistics Canada, Federal Science Expenditures and Personnel Survey 2002/2003, Annex: Intellectual Property Management 2001/2002 Fiscal Year
US Data Source: United States General Accounting Office Report to Congressional Committees: Federal Agency Efforts in Transferring and Reporting New Technology, October 2002.

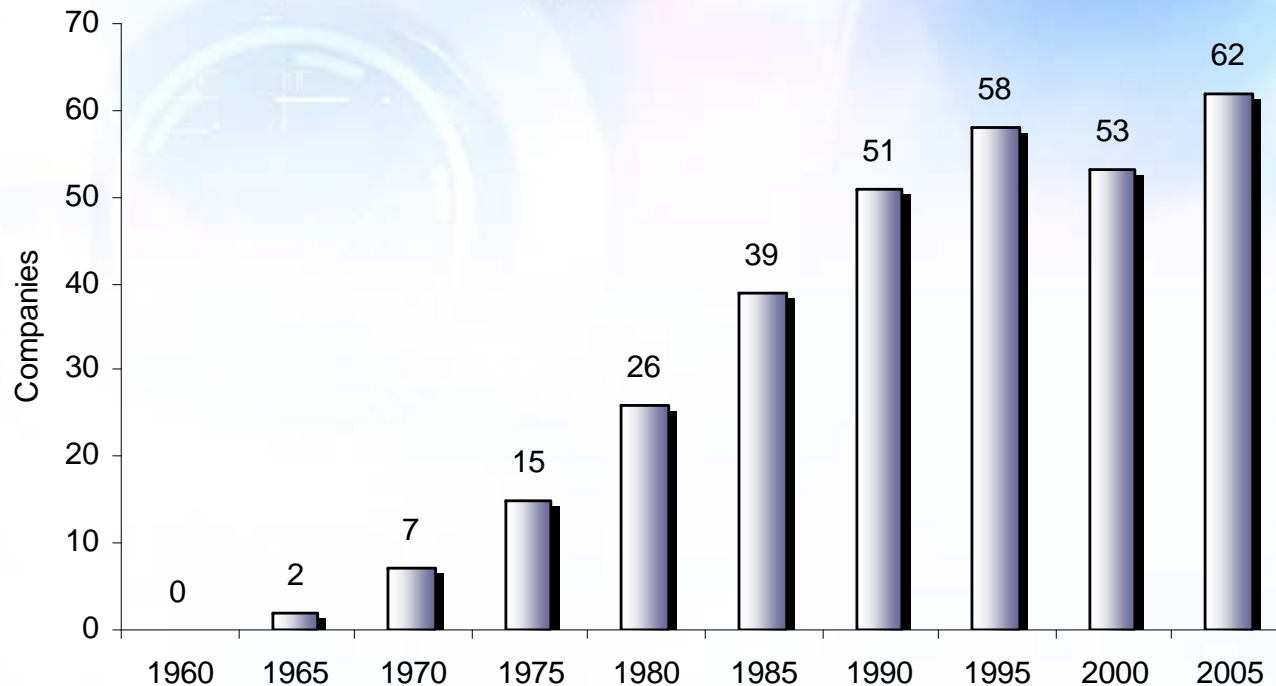
2. Canadian Data Source: Statistics Canada, Federal Government Expenditures and Personnel in the Natural and Social Sciences, 1993-1994 to 2002-2003.
US Data Source: United States General Accounting Office Report to Congressional Committees: Federal Agency Efforts in Transferring and Reporting New Technology, October 2002.

Economic Impact of Technology Transfer from CRC

- CRC Spin-Offs
 - Number of Companies
 - Employment Figures
 - Sales Revenues
- Licensing and Contracting with Existing Canadian Companies
 - Cumulative CRC Revenues
 - Cumulative Canadian Sales Due to Tech Transfer from CRC
 - Cumulative Canadian Person-Years of Employment
 - Cumulative Number of Canadian Licenses and Contracts

CRC Spin-Offs

Number of Companies

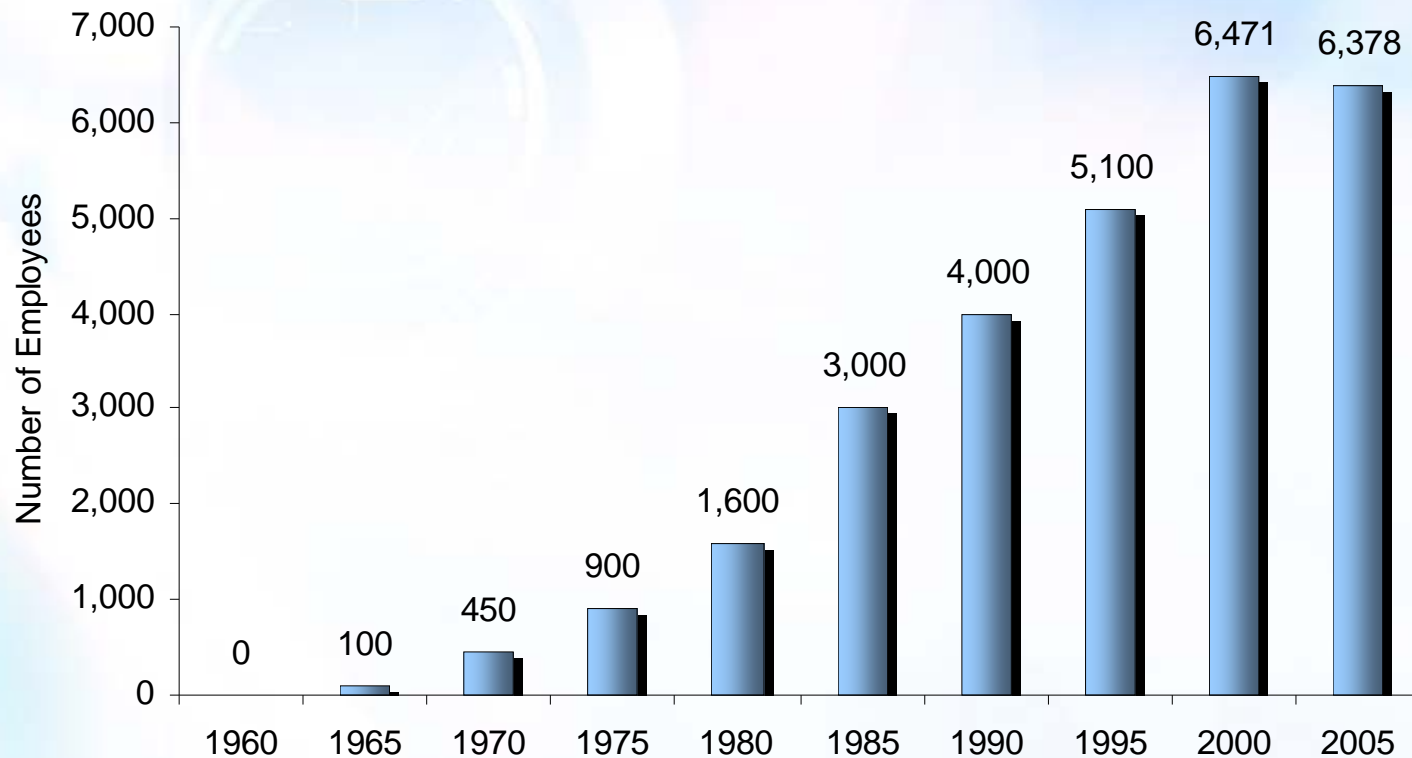


Source: Data compiled by Doyletech Corporation, October 2006

CRC Spin-offs are defined as companies which would not have been created if it was not for CRC technology and/or people.

CRC Spin-Offs

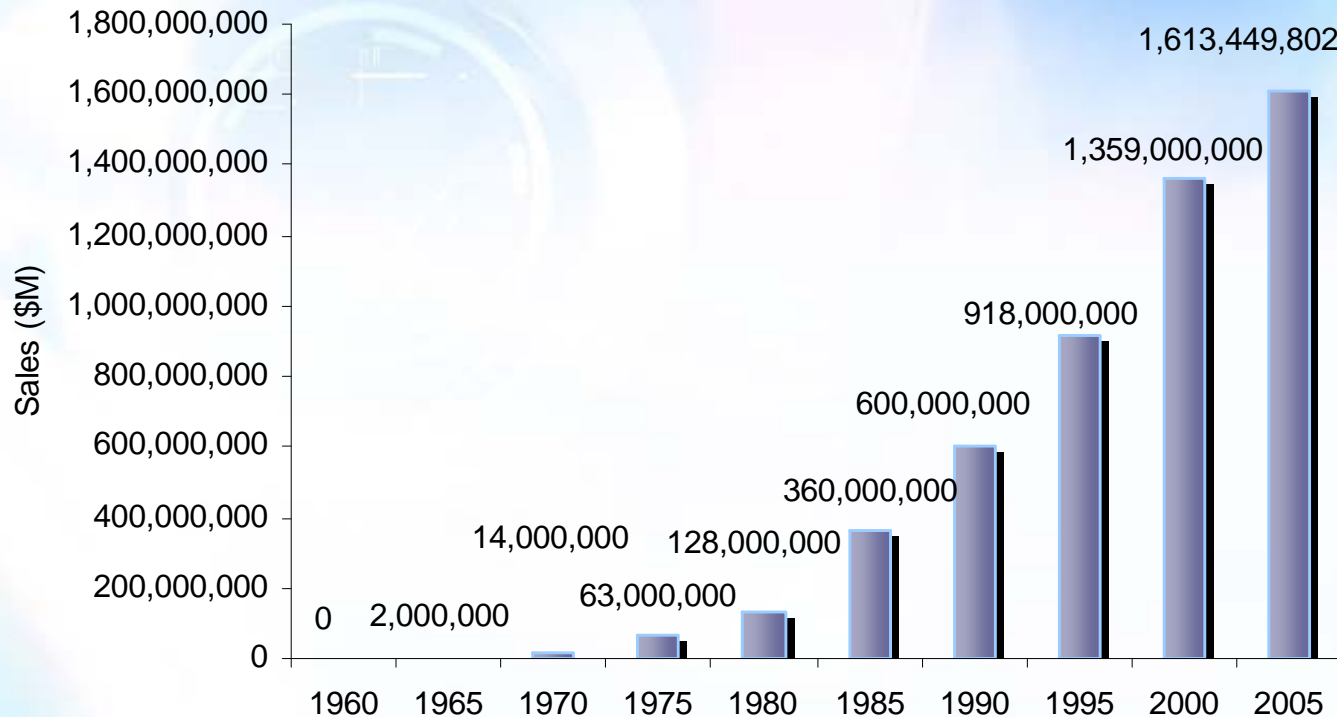
Employment Figures



Source: Data compiled by Doyletech Corporation, October 2006

CRC Spin-Offs

Sales Revenues

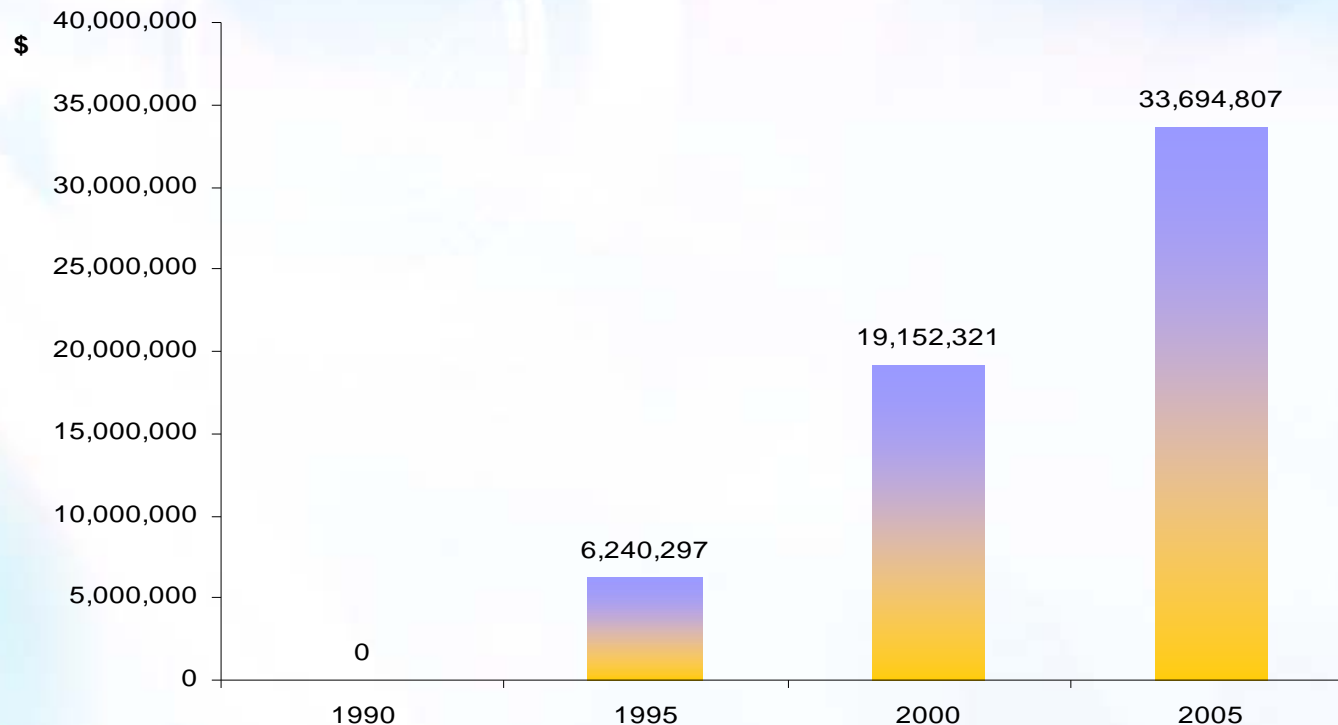


Source: Data compiled by Doyletech Corporation, October 2006

In 2005 alone, spin-off companies contributed over \$300 million in taxes from their revenues of \$1.6 billion.

Licensing & Contracting with Existing Canadian Companies

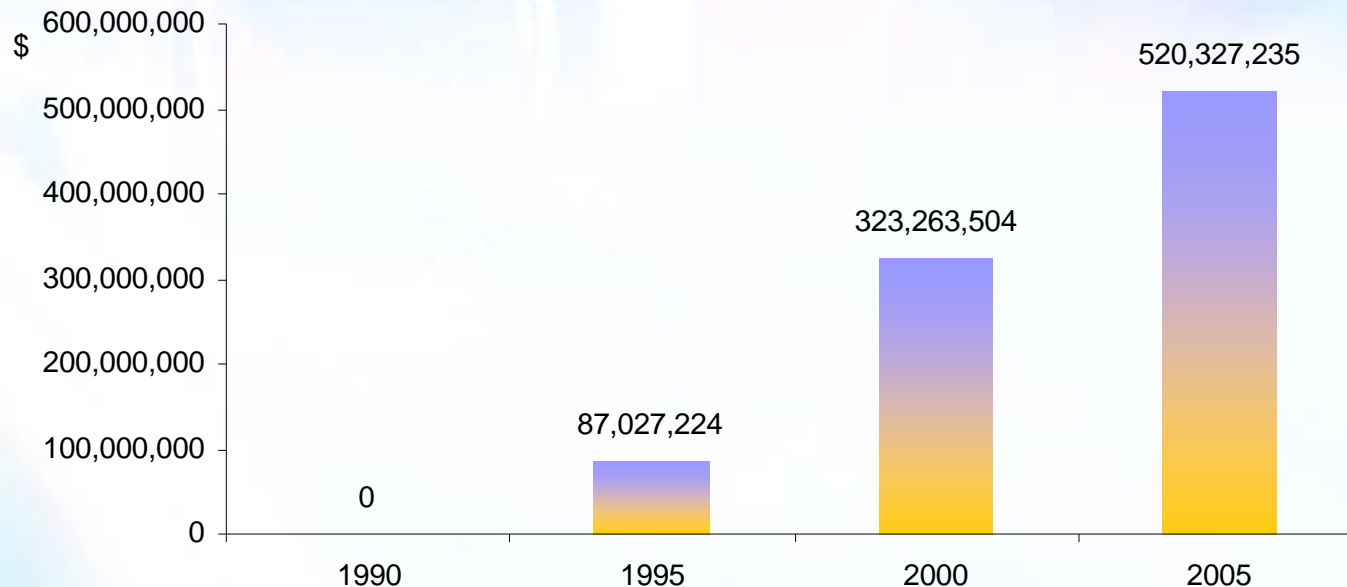
Cumulative CRC Revenue



Source: Data compiled by CRC, October 2006.

Licensing & Contracting with Existing Canadian Companies

Cumulative Canadian Sales due to Technology Transfer from CRC

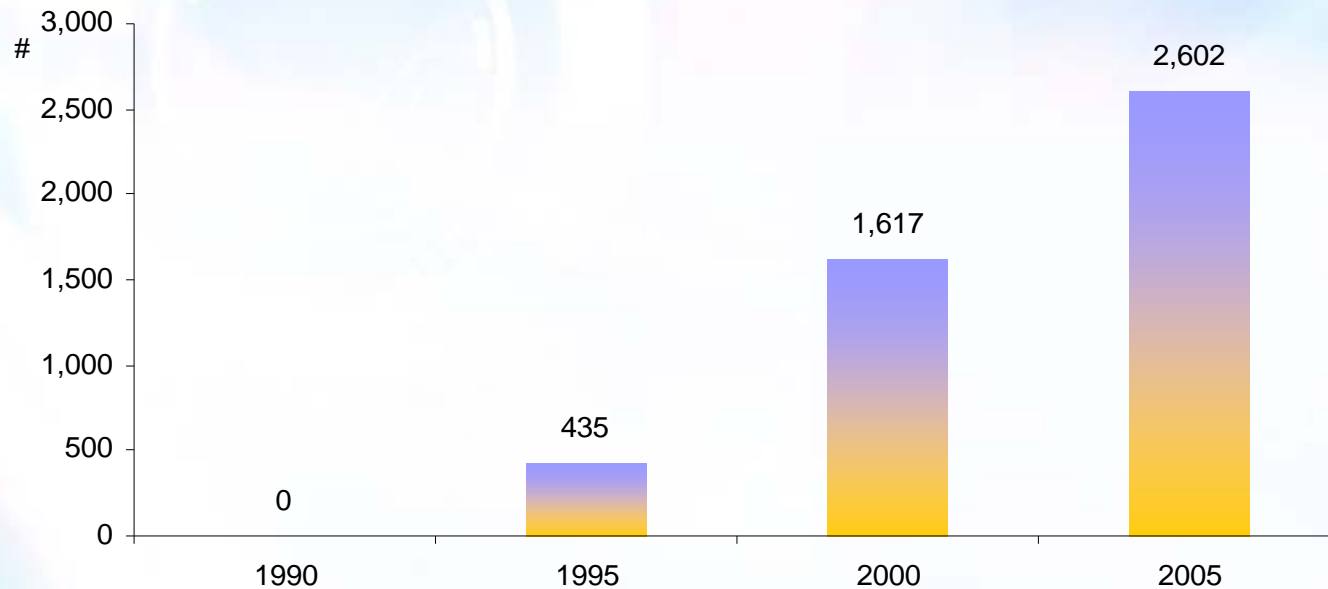


Source: Estimates by Doyletech Corporation, October 2006.

Products and Services based on technology transfer from CRC through licensing and contract R&D resulted in cumulative sales revenues of \$520 Million. The figure will be much higher if converted into 2005 dollars.

Licensing & Contracting with Existing Canadian Companies

Cumulative Person-Years of Employment

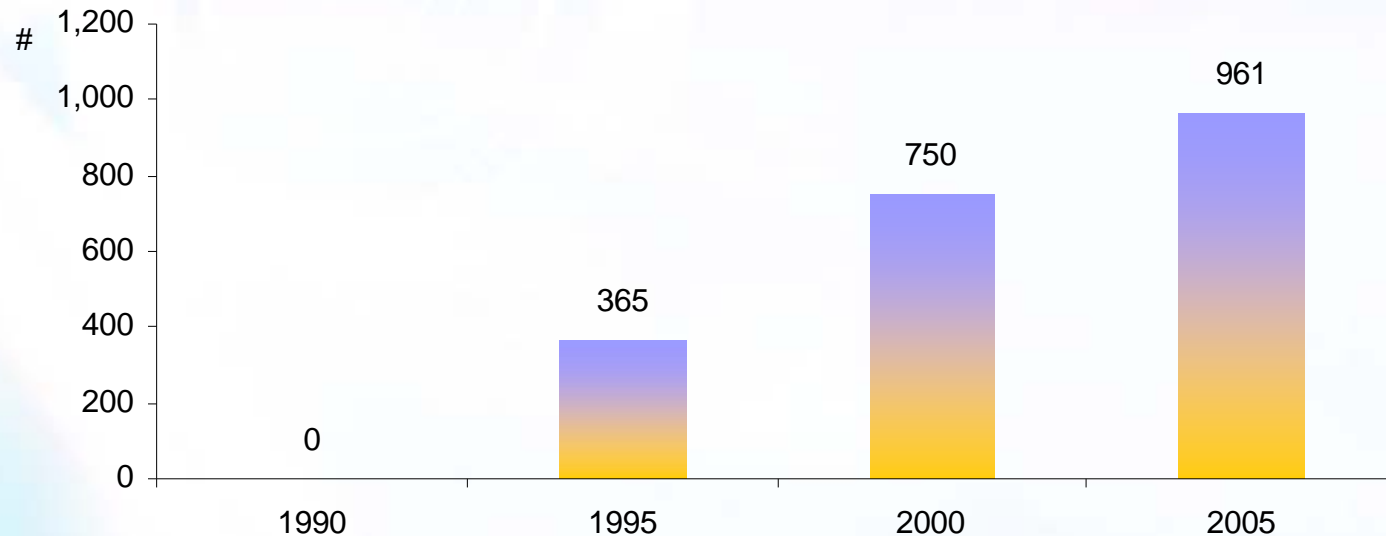


Source: Estimates by Doyletech Corporation, October 2006.

Commercialization of technology transferred from CRC to the Canadian companies resulted in the creation of 2602 cumulative person-years of employment.

Licensing & Contracting with Existing Canadian Companies

Cumulative Number of Canadian Licenses and Contracts



Source: Compiled by Doyletech Corporation from data provided by CRC, October 2006.

Success Factors

- Nature of R&D
- Location of TTO
- IP Awards
- Minimization of bureaucratic procedures and processes
- Streamlined and simple agreements; minimal use of legal counsel
- Interaction with industry through IRAP and other sources
- Cross-licensing (UTC, Toshiba)
- Patent defence (to protect our licensees)
- Patent enforcement (to protect our licensees against unfair advantage due to unlicensed competition, through the use of external law firm)
- Use of technology brokers BTG, OFT Associates and others
- Use of Innovation Centre for technology incubation

Shortcomings/Things We Like to Do

- More effective technology marketing
- Policing of infringers (we do some on a limited basis)
- Partnering / Cross Licensing / IP Bundling
- IP evaluation
- Streamlining of bureaucratic encumbrances (this may be day dreaming)
- Royalty audits (we have never done any but suspect significant revenue leakage)
- Learning from others regarding best practices
- Alignment of R&D with industry needs, where appropriate
- Commercially ready prototypes
- Access to business/financial expertise for start-ups

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Thank You!