



# Performance Measures 2005

## Critical Mass, Diversity, Industry Partnerships

iCORE has made 21 awards since September 2000: 8 chairs, 7 professors, and 6 industry chairs. This year iCORE added a Chair in bioinformatics, a Professor in the wireless cluster, and two new Industry Chairs in visualization. We now see a strong base of world-class Information and Communications Technology (ICT)-related research and a significant positive qualitative change in the research culture. Good ICT research has always been performed in Alberta universities, but now we are becoming truly world-class.

This year Alberta universities attracted more NSERC PGS students in Computer Science and Electrical Engineering. With only ten percent of the Canadian population, Alberta is now attracting 18.5 percent of NSERC students; some of Canada's best graduate students, and

a reflection of the quality of ICT research now in Alberta.

A seemingly downward trend in leveraged funding attracted by iCORE awards may be reflective of the funding cycles of other major funding programs. No new large programs were funded by the Canada Foundation for Innovation or Alberta Ingenuity in the last year, providing less opportunity for leveraging iCORE funding. Both of these large funding programs will be making major awards in the next fiscal years, so we expect the leverage of iCORE funding to increase again in the future.

The Intellectual Capital, Partnerships and Awards numbers are increasing. This is due to the larger number of awards and also to the increasing productivity of all of the iCORE Chairs.

What is difficult to reflect is the ongoing qualitative improvement in the activities that are behind these numbers. iCORE research teams publish in the highest quality journals, and have significant impact with industry and other academic researchers.

iCORE is well on its way to creating a critical mass of ICT research expertise in the province of Alberta. iCORE researchers and their teams have had a huge impact on academic research and students in the ICT-related departments, and are achieving more multi-disciplinary and industry-related results. In the future, when iCORE has a history that is longer than its current short five years, we expect to be able to report even more on the impacts being achieved in the Alberta economy.

## Summary of Performance Indicators

To gauge success, iCORE measures its performance in several major areas:		2003	2004	2005
HIGH QUALITY PEOPLE (Active)	Number of active iCORE awards	13	17	21
	Number of additional faculty members on iCORE research teams	33	59	80
	Number of active graduate students and postdocs on iCORE research teams	203	269	405
	Number of other team members	97	188	222
	Number of graduate student scholarships <sup>1</sup>	174	212	256
	Percentage of graduate students who intend to stay in Alberta after graduation	65	67	65
INTELLECTUAL CAPITAL (New)	Refereed journals and conference papers <sup>2</sup>	360	466	623
	Books or chapters	16	11	25
	Patents	5	6	8
ECONOMIC IMPACT (Active)	iCORE investment	\$28 M	\$35 M	\$41 M
	Additional funding acquired directly by iCORE research teams	\$73 M	\$102 M	\$108 M
	Direct leverage	3.6 times	3.9 times	3.6 times
	Funding acquired indirectly with iCORE research team collaborations	\$120 M	\$120 M	\$120 M
	Indirect leverage	7.9 times	7.4 times	7.0 times
	Spinout companies	4	5	5

## Partnerships

Collaborations demonstrate, through recognition by other researchers, that a researcher brings value to a larger project. iCORE researchers have many connections with colleagues around the world, and are actively involved in collaborative research projects. Details on these partnerships and industry projects can be found in the annual iCORE Research Report.

	2003	2004	2005
PARTNERSHIPS WITH RESEARCHERS	84	135	173
PARTNERSHIPS WITH INDUSTRY	49	40	52

## Awards

iCORE awardees are recognized by other adjudicated processes, reinforcing the excellence of the research supported by iCORE in Alberta. iCORE's Chairs and Professors have earned several prestigious awards.

NUMBER OF MAJOR AWARDS BY ICORE RESEARCHERS <sup>3</sup>	13	13	15
Canada Research Chairs	6	6	7
Steacie Fellowships	3	3	3
Royal Society of Canada Fellows	2	2	3
IEEE Fellows	2	2	2

## Intellectual Capital

The output of iCORE researchers is an indicator of the level of achievement in research. These measures reflect the breadth and quality of intellectual property produced, which yields both intellectual and economic returns.

PUBLICATIONS	376	477	648
Academic journals	164	184	279
Conference papers	196	282	344
Books or chapters	16	11	25
PATENTS			
Since iCORE award	5	6	8

## Economic Impact

iCORE's economic impact is measured by the amount of additional research funding that is attracted and leveraged by iCORE funding. iCORE has been very successful in attracting research investment to Alberta. For every dollar that iCORE has invested, the excellence of the people and the confidence around the research program has led to the investment of an additional 2.6 dollars directly from other sources. This significant increased input into R&D activity in Alberta will cause other activity and impact in the broader innovation system.

	2003	2004	2005
ICORE INVESTMENT TO DATE	<b>\$28 M</b>	<b>\$35 M</b>	<b>\$41 M</b>
FUNDING ACQUIRED DIRECTLY BY ICORE CHAIRS AND PROFESSORS	<b>\$73 M</b>	<b>\$102 M</b>	<b>\$108 M</b>
Federal			
Canada Foundation for Innovation	\$19 M	\$24 M	\$22 M
Canada Research Chair	\$7.5 M	\$8 M	\$8 M
Natural Sciences and Engineering Research Council	\$2.5 M	\$10 M	\$13.5 M
Provincial			
Universities	\$2.5 M	\$2.5 M	\$5.7 M
Alberta Science and Research Authority and Alberta Ingenuity Fund	\$11 M	\$20 M	\$18.5 M
Industry			
Private sector partners	\$22.5 M	\$25 M	\$29 M
Other			
	\$8 M	\$12.5 M	\$11.5 M
FUNDING ACQUIRED INDIRECTLY WITH ICORE RESEARCH TEAM COLLABORATIONS	<b>\$120 M</b>	<b>\$120 M</b>	<b>\$120 M</b>
National Research Council	\$60 M	\$60 M	\$60 M
Alberta Innovation and Science	\$60 M	\$60 M	\$60 M
DIRECT LEVERAGE	<b>3.6 times</b>	<b>3.9 times</b>	<b>3.6 times</b>
DIRECT AND INDIRECT LEVERAGE	<b>7.9 times</b>	<b>7.4 times</b>	<b>7.0 times</b>
SPINOUT COMPANIES	<b>4</b>	<b>5</b>	<b>5</b>

# High Quality People

## iCORE RESEARCH TEAMS

The total number of researchers actively engaged on iCORE research teams has grown to over 700. 21 research awards to 19 people have been funded as of March 31, 2005:

### NETWORKS AND WIRELESS

NORMAN C. BEAULIEU, Electrical and Computing Engineering, U of A  
iCORE Chair, *Broadband Wireless Communications*

CHRISTIAN SCHLEGEL, Electrical and Computer Engineering, U of A  
iCORE Professor, *High-Capacity Digital Communications Laboratory*

GÉRARD LACHAPELLE, Geomatics Engineering, U of C  
iCORE Chair, *Wireless Location Research Group*

GRAHAM JULLIEN, Electrical and Computer Engineering, U of C  
iCORE Chair, *Advanced Technology Information Processing Systems*

JAMES W. HASLETT, Electrical and Computer Engineering, U of C  
iCORE/NSERC/TRLabs Industrial Research Chair  
*Wireless Science and Technology Initiative*

HUGH WILLIAMS, Mathematics and Statistics, U of C  
iCORE Chair, *Algorithmic Number Theory and Cryptography*

CAREY WILLIAMSON, Computer Science, U of C  
iCORE Professor, *Broadband Wireless Networks, Protocols, Applications, and Performance*  
iCORE/NSERC/Telus Mobility Industrial Research Chair  
*Wireless Internet Traffic Modelling*

FADHEL GHANNOUCHI, Electrical and Computer Engineering, U of C  
iCORE Professor, *Intelligent RF Radio Technology*

### NANOSCALE AND QUANTUM INFORMATICS

MICHAEL BRETT, Electrical and Computer Engineering, U of A  
iCORE Professor, *Nanoscale Engineering Physics*  
iCORE/NSERC/Micralyne Industrial Research Chair  
*Thin Film Engineering*

MARK FREEMAN, Physics, U of A  
iCORE Professor, *Nanoscale Engineering Physics*

ROBERT A. WOLKOW, Physics, U of A  
iCORE Chair, *Nanoscale Information and Communication Technologies*  
Group Leader, *Molecular Scale Devices*  
National Institute for Nanotechnology, NRC

BARRY SANDERS, Physics, U of C  
iCORE Professor, *Quantum Information Science*

### INTELLIGENT SOFTWARE SYSTEMS

JONATHAN SCHAEFFER, Computing Science, U of A  
iCORE Chair, *High-Performance Artificial Intelligence Systems*

GUENTHER RUHE, Computer Science/Electrical and Computer Engineering, U of C  
iCORE Professor, *Software Engineering Decision Support*

RICHARD SUTTON, Computing Science, U of A  
iCORE Chair, *Reinforcement Learning and Artificial Intelligence*

HONG ZHANG, Computing Science, U of A  
iCORE/NSERC/Syncrude/Matrikon Industrial Research Chair  
*Intelligent Sensing Systems*

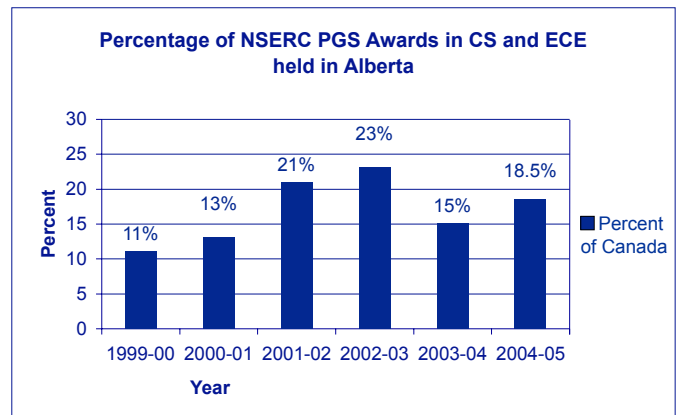
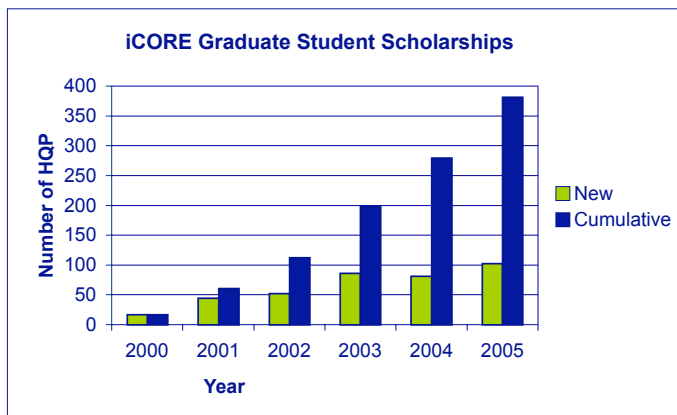
PIERRE BOULANGER, Computing Science, U of A  
iCORE/TRLabs Industrial Research Chair,  
*Collaborative Virtual Environments*

CHRISTOPH W. SENSEN, Faculty of Medicine, U of C  
iCORE/Sun Microsystems Industrial Research Chair, *Applied Bioinformatics*

STUART KAUFFMAN, Biology/Physics, U of C  
iCORE Chair, *Biocomplexity and Informatics*

### GRADUATE STUDENTS

iCORE provides scholarships to exceptionally high quality graduate students from Canada and the world. Most of these students will remain in Alberta and have a cumulative economic impact far beyond the cost of the iCORE investment.



	2003	2004	2005
Percentage of graduate students who intend on staying in Alberta after graduation	65	67	65

# High Quality Vision

## iCORE BOARD

iCORE's high-profile board of directors is selected from experienced industry, government and academic leaders. 2004-05 board members include:

DAN BADER  
Deputy Minister, Municipal Affairs  
Government of Alberta

DR MURRAY CAMPBELL  
Manager, Intelligent Information  
Analysis Department  
IBM TJ Watson Research Center

DR ROBERT FESSENDEN  
Deputy Minister  
Innovation and Science

DR PETER C. FLYNN  
Poole Chair in Management for Engineers  
Faculty of Engineering  
University of Alberta

DR R. G. (RANDY) GOEBEL  
President and CEO  
iCORE

DR PETER HACKETT  
President and CEO  
Alberta Ingenuity Fund

H.S. (SCOBEY) HARTLEY  
Vice President, Linvest Resources Corp.  
CEO, Welwyn Resources Ltd.

MARY HOFSTETTER  
President and CEO  
The Banff Centre

DR GARY KACHANOSKI  
Vice President (Research)  
University of Alberta

DR SEAMUS O'SHEA  
Vice President (Academic) and Provost  
University of Lethbridge

DR DENNIS SALAHUB  
Vice President (Research)  
University of Calgary

J.R. (ROLF) SHERLOCK (VICE CHAIR)  
Senior Partner  
BVIS Consulting Services

DR ROGER S. SMITH (CHAIR)  
Professor Emeritus, School of Business  
University of Alberta

SAMUEL ZNAIMER  
Senior Vice President  
Ventures West

## iCORE RESEARCH ADVISORY COMMITTEE

The iCORE Research Advisory Committee (IRAC) is made up of members who have extensive academic and industry research experience in a range of information and communication technologies. These scientists and industry experts from around the globe were assembled as a select group to advise iCORE on future directions. Members include:

DR DEREK CORNEIL  
Professor, Department of Computer  
Science, University of Toronto

DR JAMES GOSLING  
Chief Scientist, Java  
Vice President and Fellow  
Sun Microsystems

DR DAVID JEFFERSON  
Computer Scientist  
Lawrence Livermore National Laboratory

DR ERIC MANNING  
Professor of Computer Science  
University of Victoria

DR WILLIAM R. PULLEYBLANK  
VP, Centre for Business Optimization, IBM  
Global Services

DR RICHARD E. TAYLOR  
Professor of Physics  
Stanford University, Nobel Laureate

DR WOLFGANG WAHLSTER  
Professor, Universität des Saarlandes,  
Saarbrücken, Director and CEO of the  
German Research Center for Artificial  
Intelligence

### iCORE

3608 - 33 Street NW  
Calgary, Alberta  
Canada T2L 2A6  
tel (403) 210-5335  
fax (403) 210-5337  
www.icore.ca  
info@icore.ca

*President and CEO*  
Dr R.G. (Randy) Goebel

*Vice President, Programs*  
Lynn Sutherland

*Director of Corporate Relations*  
Fred A. Stewart

*Director of Communications*  
Sho Sengupta

*Office Manager*  
Carole Carlton

*Programs Officer*  
Lilly Wong

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Aileen Gautron

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<sup>1</sup> Active scholarship values reported are different from previous published values due to a change in definition.

<sup>2</sup> Numbers for refereed journals and conference papers include duplicates that were co-authored by more than one iCORE researcher.

<sup>3</sup> Major award values reported are different from previous published values due to a change in definition.

