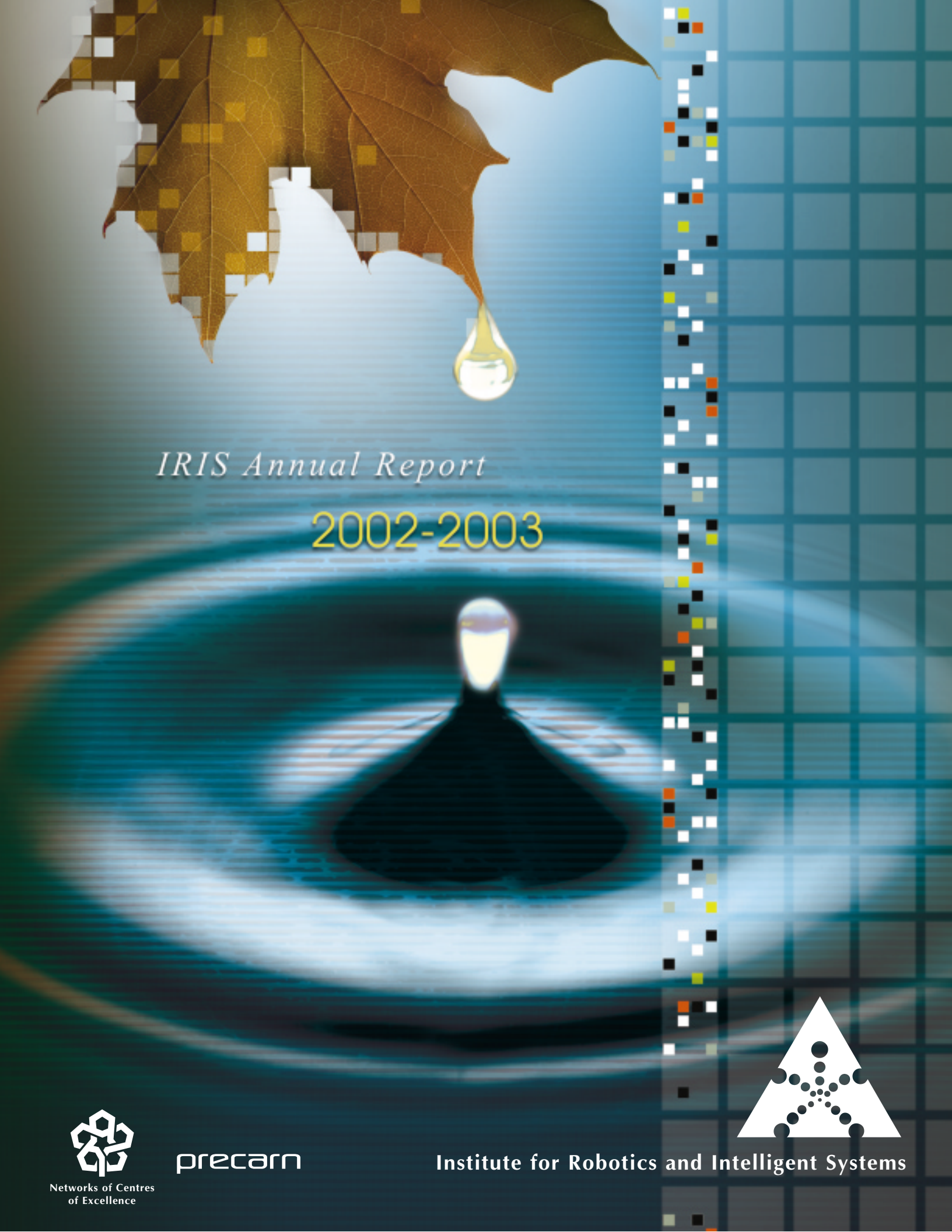


Networks of Centres of Excellence

precarn

Institute for Robotics and Intelligent Systems

Founded in 1990, the Institute for Robotics and Intelligent Systems (IRIS) is a national network of centres of world-class research expertise, comprising over 90 researchers and over 100 students in 16 universities across Canada and 2 in the U.S. IRIS focuses on collaborative research that addresses challenges and opportunities of interest to Canadian industry. Outputs include intelligent machines, vision systems and software tools, and most importantly, a continuous stream of highly qualified graduates. During the past year, 18 core IRIS projects were under way, each involving researchers at different universities working together. Approximately 100 companies, government agencies and other organizations were affiliated with IRIS projects during the year, making cash or in-kind contributions. They are in sectors as diverse as mining, insurance, telecommunications, aerospace, information technology, manufacturing and health care. IRIS is managed by Precarn Incorporated.

Intelligent Systems emulate the human ability to perceive, reason and act. They enable machines and devices to anticipate requirements and deal with environments that are complex, unknown, and unpredictable. The technologies include robotics, sensors, knowledge-based software, and the enabling human-machine interfaces.

Intelligent systems were first developed for use in traditional industries, such as manufacturing, mining and forestry, to enable the automation of routine or dangerous tasks in an effort to improve productivity. Today, there are intelligent systems applications in virtually all sectors of the Canadian economy.

TABLE OF CONTENTS

SCIENTIFIC CHAIR'S MESSAGE

Nearing the end of its NCE status, IRIS is showing no signs of winding down. The last year has seen more new programs launched and more recognition from industry, than at any other time in its history.

New programs are helping to position IRIS for its life beyond 2005. The Emerging Opportunities Fund was set up to provide short-term funding to investigate the potential of exciting new ideas. Approved projects involve new or unanticipated research that has either emerged from current IRIS work, from other supported research, or is an unanticipated idea that needs further exploration. This program is aimed specifically at newcomers to the world of academic research -- which allows a double benefit of obtaining fresh ideas and introducing IRIS and Precarn to a new group of innovative researchers. The Precarn Scholars program, funded by Precarn Incorporated to the tune of $1 million, was put in place to help keep highly qualified people in the Canadian intelligent systems research community. The funds, directed to the core IRIS projects, were allocated in the form of graduate student scholarships.

The regular research program ran 18 core projects, two PUL projects and four T-GAP projects. Three start-up companies spawned from the research of the T-GAP projects - ApStat Technologies, RealContact Inc. and Intrignia Solutions. And so the pulse of IRIS research, as can be seen from these few examples of this year alone, will continue to beat and exciting ideas and opportunities will be uncovered for years to come.

The IRIS research community has matured a good deal over its 13-year history, and welcomes a closer association with the commercial enterprises that make up Precarn. The two Canadian intelligent systems research networks are closely linked by focus, and will continue to grow more entwined in the coming years - a relationship that, I believe, will see both parties grow stronger and emerge as a single, seamless entity.

Each year as I sit down to pen these words, I reflect on the network and how it has evolved in the last year, and since its inception. I am honoured to be so closely connected to this important group and look forward to its continued prosperity beyond 2005.

Bernie MacIsaac,
Scientific Chair, IRIS Research Management Committee

The IRIS Mission is to promote high-quality collaborative research in intelligent systems, which is of strategic importance to Canadian industry and to strengthen the R&D interaction between universities and industry, thereby improving the competitiveness of Canadian firms.

Institute for Robotics and Intelligent Systems (IRIS)
80 Aberdeen Street
Suite 400
Ottawa, Ontario K1S 5R5

Tel: (613) 727-9576
Fax: (613) 727-5672
info@precarn.ca
www.precarn.ca

MESSAGE FROM THE PRESIDENT OF PRECARN

IRIS is busy -- more than half-way through its final phase of NCE funding and the network is more vibrant and productive than ever! Eighteen projects underway, new start-ups and lots of company and media interest in the research.

I looked around the tradeshow floor at the annual conference in Halifax and felt an overwhelming sense of being part of something important. IRIS began 13 years ago and has grown into a network of more than 200 researchers and students from universities across Canada, connecting with more than 100 companies, to perform research that impacts daily life. It is exciting to watch the connections and collaborations develop beyond the conclusion of the IRIS projects and we see that most clearly each year at the conference.

In 2005, the NCE funding for IRIS will end and the organization will cease to be eligible for those funds. IRIS is an integral part of the Precarn network, and IS research in Canada, and we are working to keep it going, by building an integrated university/industry/government R&D program. Precarn has already started with the Precarn Scholars Program and the Precarn University-Led Program, and will continue its efforts to sustain and enlarge this vital network beyond 2005. I am personally convinced that the future of Canada's intelligent systems industry, which is a key driver of innovation and prosperity, depends importantly on university-led research and on the graduate students trained under IRIS programs; that is why university-led research will continue to be an important program component of the "new" Precarn for many years to come.

Thank you to all of the supporters and friends of this program - and, of course, to the researchers and the IRIS Research Management Committee - all of whom play important roles in the network's success.

Anthony T. Eyton,
President and CEO of Precarn
and Director of IRIS

BOARD OF DIRECTORS 2002-03

Prabha Kundur (1) (Chair), BC Hydro/Powertech Labs Inc.
Judith A. Whittick (1) (Vice-Chair), C-CORE
Jim Roche (1) (Past Chair), Tundra Semiconductor Corporation
Yves Langhame (1) (Secretary-Treasurer), Institut de recherche d'Hydro-Québec
Alain Allard, R/D Tech
Greg Baiden, Penguin ASI
Jean-Paul Boillot, Servo-Robot Inc.
D.W. (Don) Denney, Syncrude Canada Ltd.
Anthony T. Eyton (1), Precarn Incorporated
Randy Goebel, University of Alberta
Paul Guild, University of Waterloo
Peter Hackett, National Research Council Canada
James Middleton, MD Robotics
Paul Pearl, DIPIX Technologies Inc.
Pierre Richard, Canadian Space Agency
Grant Thomas (2), KRC Knowledge Resources Canada Inc.
Deborah L. Weinstein, LaBarge Weinstein

(1) Member, Executive Committee
(2) NCE appointment

Front row, left to right: D.W. (Don) Denney, Judith A. Whittick, Prabha Kundur, Grant Thomas. Back row, left to right: Paul Guild, Greg Baiden, Jean-Paul Boillot, Peter Hackett, Yves Langhame, Paul Pearl, Anthony T. Eyton.

IRIS RESEARCH MANAGEMENT COMMITTEE 2002-03

Bernie MacIsaac (Scientific Chair), GasTOPS Ltd.
James Clark, McGill University
Anthony T. Eyton, Precarn Incorporated
David P. Jones, University of British Columbia
Claude Lacoursière, Critical Mass Labs
Marin Litoiu, IBM Centre for Advanced Studies
James Little, University of British Columbia
Evangelos E. Milios, Dalhousie University
Adele Newton, University of Toronto
Raymond Ng, University of British Columbia
Grant Thomas *(NCE Appointment)*, KRC Knowledge Resources Canada Inc.
John Tsotsos, York University

OBSERVERS
Chantal Abou Debs, Networks of Centres of Excellence (NCE)
Paul Johnston, Precarn Incorporated
Rick Schwartzburg, Precarn Incorporated

STRENGTH IN NUMBERS

precarn MEMBERS

Abitibi Consolidated Inc.
Alberta Research Council
AMEC E&C Services Limited
Atomic Energy of Canada Limited
ATS Automation Tooling Systems Inc.
Axonwave Software Inc. *(formerly Gavagai Technology Inc.*
BC Advanced Systems Institute
BC Hydro / Powertech Labs Inc.
Bell Canada
Biomedical Photometrics Inc.
BMT Fleet Technology Limited
Business Development Bank of Canada
Canadian Centre for Marine Communications
Canadian Space Agency
CANARIE Inc.
CARIS
C-CORE
Centre de recherché industrielle du Québec
Centre de recherche informatique de Montréal
Clevor Technologies Inc.
CMC (Canadian Microelectronics Corporation)
Comact Optimisation Inc.
Communications and Information Technology Ontario (CITO)
Delcan Corporation
Delta Controls, Inc.
DIPIX Technologies Inc.
Fiber Optic Systems Technology Inc. (FOX-TEK)
Forintek Canada Corp.
GasTOPS Ltd.
Hall Coastal Canada Ltd.
HATCH
I.C. Vision Inc.
I-M Innovations Inc.
Immersion Canada Inc.
Inco Limited
Institut de recherche d'Hydro-Québec
Intelligent Materials and Systems Institute (IMSI)
MacLean Engineering & Marketing Co. Ltd.
Matrikon Inc.
MD Robotics
National Defence / Defence R&D Canada
National Research Council Canada

IRIS UNIVERSITIES

University of Alberta
University of British Columbia
University of Calgary
Carleton University
Dalhousie University
University of Guelph
John P. Robarts Research Institute
Lakehead University
Université Laval
McGill University
Université de Montréal
Queen's University
Simon Fraser University
University of Toronto
University of Waterloo
University of Western Ontario
York University
Carnegie Mellon University
University of Illinois at Urbana-Champaign

Natural Resources Canada
Neptec Design Group Ltd.
Novax Industries Corporation
Ontario Power Generation Inc.
Qubit Systems Inc.
Quester Tangent Corporation
R/D Tech
Range and Bearing Environmental Resource Mapping Corporation
Saskatchewan Research Council
SGDL Systems Inc.
SMART Technologies
Smiths Detection
Syncrude Canada Ltd.
Techné Knowledge Systems Inc.
Thompson Rosemount Group Inc., The
TISEC Inc.
Tundra Semiconductor Corporation
VerifEye Inc.
Wenco International Mining Systems Ltd.

IRIS CONTRIBUTING ORGANIZATIONS

Alberta Software Engineering Research Consortium (ASERC)
Atamai Inc.
AVAYA Canada
Bell Canada
BioWare Corp.
Cellula Robotics Ltd.
Celoxica Inc. - America Region
Centre for Research in Earth & Space Technology (CRESTech)
CIBC
Cimmetry Systems, Inc.
Critical Mass Labs
Delfi Medical Innovations Inc.
Electronic Arts (Canada) Inc.
GE Medical Systems Canada
IBM Almaden Research Center
IBM Canada Ltd.
Idilia Inc.
Immersion Canada Inc.
Immersion Corporation
MD Robotics
Merck Frosst Canada Ltd.
MPB Technologies Inc.
Neil Squire Foundation
Nissan Research Center
Point Grey Research Inc.
Precarn Incorporated
Quanser Advanced Control Systems
Radical Entertainment
Tactex Controls Inc.
Transport Canada
Ultrasonix Medical Corporation
University Health Network
VisionSphere Technologies
VisuAide Inc.
Wavemakers Research Inc.
Xilinx Technologies Corp.

IRIS START-UPS

Apstat Technologies Inc.
Atamai Inc.
Axonwave Software Inc. *(formerly Gavagai Technologies Inc.)*
Constraint·Works Corporation
Cortex Machina Corporation *(acquired by Cynovad)*
Credo Interactive Inc.
DBMiner Technology Inc.
HexaVision Technologies Inc. *(acquired by Adept Technology, Inc.)*
iGO Technologies Inc.
Immersion Canada Inc. *(formerly Haptic Technologies Inc., acquired by Immersion Corp.)*
Infusion Systems Ltd.
InnovMetric Software Inc.
Intrignia Solutions, Inc.
LocusDialog
Mercator Robotec Inc.
Motion Metrics Inc.
Palomino System Innovations Inc.
PhoeniX Technologies Inc.
Point Grey Research Inc.
Precision MicroDynamics, Inc.
RealContact Inc.
SysCor R&D Inc.
Techné Knowledge Systems Inc.
VisImage Systems Inc.
Wavemakers Research Inc.
Zante Visual Systems Inc.

IRIS AND PRECARN STAFF

Anthony T. Eyton
President & CEO

Paul Johnston
Vice President, Operations

PRECARN PROGRAM

Peggy MacTavish
Director, Research Programs

Derek Best
Senior Manager, Research Projects

Colin Taylor
Manager, Research Projects

Wendy McDiarmid
Program Support, Research Projects

BUSINESS DEVELOPMENT

Graham Taylor
Director, Business Development

Cheryl Elliott
Communications Officer

Julie Haywood
Communications Officer

Celeste Burnie
Member Relations Coordinator

Maryse Côté-Singer
Events Coordinator

IRIS PROGRAM

Rick Schwartzburg
IRIS Network Manager

Faye Bush
Program Support, IRIS

ADMINISTRATION

Elizabeth Boydell
Manager, Financial Operations

Karen Gaw
Executive Assistant

BRINGING PEOPLE AND TECHNOLOGY TOGETHER

IS 2003: 13th Annual Canadian Conference on Intelligent Systems

The French writer and aviator, Antoine de Saint-Exupery, once wrote: "If you want to build a ship, don't drum up people to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea." These were the opening words of Marc Garneau, president of the Canadian Space Agency, as he kicked off the 13th Annual Conference on Intelligent Systems in Halifax. He spoke of Canadian accomplishments in robotics research and Canada's integral role in international space exploration missions.

Other keynotes included advice on taking technology from the university research lab to the international market. Ernest Reimer, president of Canpolar East Inc., shared his own story and lessons learned, giving the audience an honest look at his process and what it took to make the transition successfully. His five "Strategies for Success" are 1) Don't emulate the discovery value chain; 2) Add value; 3) Get as close as possible to your customers; 4) Collaborate with competitors; and 5) Innovate.

Walter Bender, Executive Director at the Media Laboratory at MIT, spoke about the lab's work and its philosophy of learning and expressing by machines. This internationally acclaimed lab has a credo of "learn by doing" which resonated clearly with the listeners.

TECHNOLOGY SHOWCASE

Demonstrations of surgical tools for closing incisions, robots that are being developed to aid the elderly, and more than 40 others, along with 60 academic posters were just some of the highlights on the tradeshow floor. With more than 200 participants wandering the area and popping into the technology snapshot sessions, it was a busy space with lots to see, experience and learn.

WORKSHOPS

A special session on marine technology had strong participation and good discussion, as did the three workshops: Funding Your R&D Activity; Applied Research at Canadian Colleges and Institutes; and, Algorithms to Prototypes: System-on-Chip Research Opportunities.

This annual gathering of intelligent systems researchers and industry provides a once-a-year opportunity to come together to showcase the year's lab work and to make connections with like-minded colleagues.

AWARD WINNERS

Each year students from the IRIS network present their research through posters and demonstrations at the annual conference. It is always a highlight of the event and provides a sneak peek into both the wealth of talent at our universities and into the future of intelligent systems in Canada.

Best Poster Winners:

Sam Bromley, University of Guelph, *Substituting Touch for Vision*

Tina Ehtiati, McGill University, *Context-Based Object Detection*

Kathleen Surry, John P. Robarts Research Institute, *Three Dimensional Ultrasound and Stereotactic Mammography Guided Biopsy: A Dual Modality System*

Best Demonstration Winner:

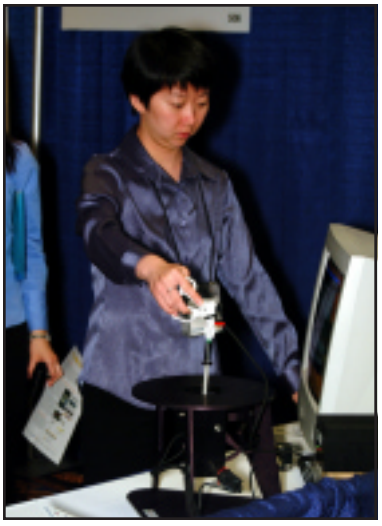
Simon DiMaio, University of British Columbia, *Simulated Interactive Needle Insertion*

Congratulations to the winners and thank you to all that participated in this year's Showcase.

Best Poster Winners: (from left to right) Bernie MacIsaac, GasTOPS Ltd. - Poster Award Sponsor; Tina Ehtiati, McGill University; Kathleen Surry, John P. Robarts Research Institute; Sam Bromley, University of Guelph; and, Pierre Dumouchel, Centre de recherche informatique de Montréal (CRIM) - Poster Award Sponsor.

Simon DiMaio (right), University of British Columbia, winner of the Best Demo "Simulated Interactive Needle Insertion", is pictured with Paul Pearl, DIPIX Technolgies Inc. - Demo Award sponsor.

Precarn Scholar, Stéphane Pelletier of McGill University, explains his poster "High-Resolution Video Synthesis From Mixed-Resolution Video" to an IS 2003 delegate.



Hilary Zhang, Simon Fraser University, demonstrates "Laproscopic Training Environment (LTE)" at IS 2003 in Halifax.

2003 GORDON M. MacNABB SCHOLARSHIP WINNER REACHES FOR THE MOON

Topping nearly 50 highly qualified applicants, Stephen Smith, a recent graduate in Engineering Physics from Queen's University, was the 2003 recipient of the Gordon M. MacNabb Scholarship. In the fall, he will begin Master's studies at the University of Toronto, pursuing research in the control and design of autonomous robotics for planetary exploration, with the Systems Control Group, in the Electrical Engineering department.

The Gordon M. MacNabb Scholarship Foundation was founded 1993 as a charitable organization to support graduate students studying and working in the area of robotics and intelligent systems. The Foundation has awarded $5,000 scholarship supplements each year since its inception.

Pictured from left to right: Marc Garneau, IS 2003 Keynote Speaker; Stephen Smith, 2003 Gordon M. MacNabb Scholarship Winner; and, James Middleton, MD Robotics - Scholarship Sponsor.

IRIS RESEARCH PROGRAMS

2002-2003 was a year of growth for IRIS as three new funding programs were initiated. These were the Emerging Opportunities Fund, the Precarn University-Led Program and the Precarn Scholars Program. The Emerging Opportunities Fund and Precarn University-Led Programs were designed to attract people who are new to the network as well as to push the envelope of collaborative, intelligent systems research. These initiatives are in addition to the on-going core research program of IRIS described on pages 14 - 21.

Precarn University-Led Program

One of the real strengths of Precarn is its affiliation with the Canadian university community. For more than a decade, IRIS has been the main link through which this connection has been supported. As we move toward our vision of a fully integrated organization by 2005, Precarn is implementing programs to continue building on this solid base.

The Precarn University-Led (or PUL) Program, funded by Industry Canada, accelerates the creation and adoption of innovative IS technologies through the support of university-industry interaction - from idea creation through project completion. It supports university led, intelligent systems research projects that implement innovative techniques for interacting with Canadian industry and other partner organizations.

In February 2003, two PUL projects were recommended by the IRIS Research Management Committee, and subsequently approved by the Board of Directors.

The Cognitive Project - Intelligent System Requirement for Cognitively Impaired Individuals

Project Co-Leaders:
Profs. Jacob Slonim and Nick Cercone, Dalhousie University

Participants: University of Toronto, University of Waterloo, University of Alberta, IBM Centre for Advanced Studies, Bell University Labs, Pattern Discovery Software Systems

The objective of the project is to alter the course of the progressive loss of independence in people with Alzheimer's disease or mild cognitive impairment by implementing intelligent systems technologies for use in everyday life. In turn, this independence can delay placement in a care facility or the level of attention required by a caregiver lessening the impact on care facilities.

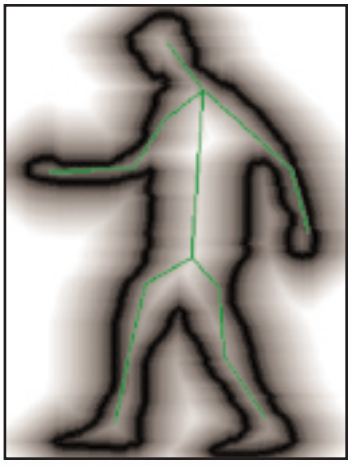
Rehabilitative assistance has the higher long-term potential in assisting people with Alzheimer's disease and, indirectly, impacting the Canadian economic and health care systems. Rehabilitation would allow the individual to retain their autonomy for longer, increasing their quality of life, their sense of self, and their independence. If intelligent systems can provide support for rehabilitation, the reliance on pharmaceutical products in present rehabilitation strategies can be reduced.

MONNET - Monitoring of Extended Premises: Tracking Pedestrians Using a Network of Loosely Coupled Cameras

Project Co-Leaders:
Profs. Denis Laurendeau and Robert Bergevein, Université Laval

Participants: Queen's University, York University, National Research Council Canada, Centre de recherche informatique de Montréal, Teorem Interactif, Defense R&D Canada

The purpose of the project is to develop a computer vision-based monitoring system that aims to analyze image sequences from a network of cameras disposed at various locations sparsely covering the extended premises under observation and connected to computing "nodes". Each node of the system needs to detect and track persons in a field of view of its assigned cameras, characterize these persons in terms of their shape and appearance, memorize the time interval during which the persons are visible, estimate the direction taken by these persons, broadcast relevant information to other nodes on the network, and build a log file describing the activity that has occurred in the monitored areas.



This image shows how software matches a stick figure against the image of a person taken by the camera. The image analysis is performed by motion-tracking software developed in the MONNET project.

IRIS RESEARCH PROGRAMS

Technology Gap Assistance Program

T-GAP is IRIS' innovative technology transfer initiative. The program is designed to take technologies from the university and bring them closer to commercial readiness. This can involve the building of engineering prototypes, refining and implementing designs, conducting scale-up activities, conducting field studies, or carrying out technical and market assessments.

In 2002-03 alone, IRIS supported four T-GAP projects totalling $322,549, two of which have been completed. Descriptions of the four projects follow.

Completed projects

Resulting from work developed in the LEARN project, Professor Yoshua Bengio of the Université de Montréal developed robust learning algorithms that have application in the insurance industry. With the assistance of T-GAP funding, Professor Bengio was able to transfer this technology to ApStat Technologies, a spin-off company created by his former students.

Jamie King, an IRIS graduate student in Professor Ray Gosine's group at C-CORE / Faculty of Engineering and Applied Science at Memorial University, started a company called Intrignia Solutions. The company is based on work done by Mr. King and Professor Gosine. T-GAP provided funding to help Mr. King demonstrate the reliability of Intrignia's multiple robot control and coordination technology. This technology provides for scheduling and coordinated control of multiple automated vehicles and is targeted primarily at the underground mining industry.

Projects Underway

In 2002, Dr. Mohsen Mahvash Mohammadi created RealContact Inc. This company is a direct result of his work under the direction of Dr. Vincent Hayward of McGill University and the Hi-VEC project. Under this project, RealContact is developing force feedback simulators for surgery training.

The final T-GAP project being supported involves 3D interactive modeling and is awarded to Professor Patrick Hébert of Université Laval. The project will develop a portable 3D acquisition system and multi-threaded 3D acquisition and modeling software optimized for real-time performance.

Emerging Opportunities Fund

In mid-2002, IRIS introduced the Emerging Opportunities Fund (EOF) Program. The objective of the fund is to provide short-term funding to investigate the potential of exciting new ideas. These projects look at new or unanticipated research that has either emerged from current IRIS work, from other supported research, or is a new, unforeseen idea that needs further exploration. It is not intended to support current IRIS projects that want to extend their current research along a new idea. Application was restricted to those people who were within five years of commencing their first academic appointment in Canada. A maximum award of $35,000 was possible.

Twenty-four proposals were submitted and reviewed. Of these 15 were awarded. A summary of these follows.

Purang Abolmaesumi, Queen's University, will explore the application of ultrasound imaging in computer-assisted preoperative planning and telesurgery - believed to be a more cost-effective, efficient, and safer option for patients than current medical imaging tools such as X-ray, Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). Dr. Abolmaesumi will be collaborating with Dr. David Pichora, a surgeon and Chair of the Division of Orthopaedic Surgery at the Kingston General Hospital.

Laurence Capus, Université Laval, will develop an educational Web tool to help students become better problem solvers, a high-level skill which is essential in computer science, and other scientific fields, and which studies have found lacking among many students. Dr. Capus' work is expected to lead to the creation of new models in educational engineering that can benefit other educational intelligent applications as well.

Nando de Freitas, University of British Columbia, will work to create realistic, human-like computer game characters using artificial intelligence (AI) tools and supported by data mining of massive amounts of information generated by people playing games on the Web - a feat which will greatly benefit computer gaming, one of the fastest growing industries in the world.

Michael Greenspan, Queen's University, will create a robotic system that can play competitive pool against a human opponent, with the goal of helping to enhance the perception, planning, and action capabilities of intelligent systems, and to create more effective robotic solutions.

IRIS RESEARCH PROGRAMS

EOF (CONT'D)

Keyvan Hashtrudi-Zaad, Queen's University, will develop a telerobotic system capable of adjusting its performance based on an operator's arm movements in order to enhance levels of telepresence (the ability of a robotic system to react to its surroundings in the same way a human would) for space exploration, underwater operations, medical procedures and rescue missions.

Malcolm Heywood, Dalhousie University, aims to enhance the ability of intrusion detection systems to protect global computer networks by creating a distributed detection tool which can learn normal network behaviour and - working in real-time to anticipate computer security threats - guard against attack by detecting abnormal behaviour.

Martin Jagersand, University of Alberta, will investigate predictive display systems and their ability to improve the performance of remote robots used in telerobotics, including those involved in space exploration, emergency response and chemical waste clean-ups. The goal is to greatly reduce the time delay that normally occurs between an operator's movements and the corresponding movements of the robot (as projected on the display) - enhancing the accuracy with which an operator can control the robot.

Hanif Ladak, University of Western Ontario, will design and test unique software for accurately modelling blood vessels, in order to assist in disease diagnosis, monitoring, and surgical planning. The computer-based models will consist of the same physiological shapes and properties as real blood vessels, and will be tested for accuracy against blood vessel drawings produced by experts using computer-based drawing tools.

John Madden and Joseph Yan (Team), University of British Columbia, will explore new technologies for creating low-cost, insect-like aerial robots capable of autonomous flight. Such miniscule robots have potential application in security and law enforcement, power line inspection, urban monitoring and the military - for use in surveillance, over-the-hill reporting, risk analysis for biological and chemical threats, and target identification and designation.

Ken McIsaac and Jagath Samarabandu (Team), University of Western Ontario, will take the first step towards the creation of a computerized "seeing-eye dog," using a more complex application of mobile robotics to help visually impaired people navigate in an unknown environment, and live with a greater degree of confidence and independence, than prior work by other researchers has achieved.

Mehrdad Moallem, University of Western Ontario, will investigate ways to significantly enhance robots used in clinical devices, including those used by surgeons in minimally invasive heart bypass surgery, high-precision endoscopic surgery, breast and prostrate biopsy, and knee replacement surgery, in order to provide better precision when it comes to positioning (when inserting a needle for biopsy purposes) or exerting force (when making an incision).

Inna Sharf, McGill University, will test a unique concept for emulating the weightless environment of space here on earth, with the ultimate goal of designing an intelligent system capable of guiding robots as they interact with free-flying objects in space - a feat that will make the removal of space debris as well as in-orbit servicing and repair of satellites, a reality.

Abdelhamid Tayebi, Lakehead University, will work to create intelligent robots capable of learning from past mistakes in order to perform progressively better in the future - a development that is key in manufacturing industries, where errors are tracked and the same operations are repeated over and over again on a robotic assembly line.

Gabriel Wainer, Carleton University, will generate a development platform for real-time controllers using modelling techniques to reduce end costs and risks, and enhance capabilities, of the growing number of computer systems (automated traffic control applications, intelligent manufacturing systems, autonomous robots, etc.) that need to control automated tasks with a higher level of complexity than ever before.

John Zelek, University of Guelph, will explore relaying navigational information, such as obstacles, terrain and depth, to a visually-impaired person using a portable tactile glove made up of vibrating motors and a wearable computer and camera system.

IRIS RESEARCH PROGRAMS

Precarn Scholars

As part of its effort to support the retention of highly qualified personnel in intelligent systems in Canada, Precarn provided IRIS with $1 million in funding to support graduate student scholarships. This money was used to help the 18 core IRIS projects attract and retain the best and brightest students. Fifty-seven "Precarn Scholars" from universities across Canada - including Dalhousie University, McGill University, Université de Montréal, University of Toronto, York University, Queen's University, University of Waterloo, Western University, University of Calgary, University of Alberta, Simon Fraser University and University of British Columbia - have been selected by IRIS project leaders to receive this first tranche of funding. Principal Investigators nominate students to the Project Leader based on an allocation to each project.

***Maryse Boisvert**, Université de Montréal*
***Kevin R. Brown**, University of Toronto*
***Matthew Brown**, University of British Columbia*
***Gianni Campion**, McGill University*
***Peter Carbonetto**, University of British Columbia*
***Nicolas Chapados**, Université de Montréal*
***Lei Chen**, University of Waterloo*
***Zhimin Chen**, University of British Columbia*
***Daniela Constantinescu**, University of British Columbia*
***Konstantinos G. Derpanis**, York University*
***Hanifa Dostmohamed**, McGill University*
***Tina Ehtiati**, McGill University*
***Pantelis Elinas**, University of British Columbia*
***Giselle Flaccavento**, University of British Columbia*
***Ben Forsyth**, University of British Columbia*
***Danny French**, University of British Columbia*
***Julian Guerrero**, University of British Columbia*
***Ziad M. Hafed**, McGill University*
***Jesse Hoey**, University of British Columbia*
***Andrew Hogue**, York University*
***Yuelong Jiang**, Simon Fraser University*
***Nathan Kendrick**, University of Calgary*
***Dustin Lang**, University of British Columbia*
***Joel Laurent Lanovaz**, Queen's University*
***Pierre-Olivier Laprise**, McGill University*
***Vincent Levesque**, McGill University*
***Fahong Li**, University of British Columbia*
***Zhonghai Li**, University of Toronto*
***Hui Liu**, Dalhousie University*
***Yueju Liu**, York University*
***Patricia McAllister**, Queen's University*
***Donald R. Murray**, University of British Columbia*
***Pinar Muyan**, University of British Columbia*
***Jonathan Newton**, University of Alberta*
***Borna Noureddin**, University of British Columbia*
***Jean-François Paiement**, Université de Montréal*
***Themistoklis Palpanas**, University of Toronto*
***Jerome Pasquero**, McGill University*
***François Payette**, Université de Montréal*
***Stéphane Pelletier**, McGill University*
***Sandra Polifroni**, York University*
***Pascal Poupart**, University of Toronto*
***James M. Redford**, University of Alberta*
***Ruslan R. Salakhutdinov**, University of Toronto*
***Iryna Skrypnyk**, University of British Columbia*
***Robert St-Aubin**, University of British Columbia*
***Christine Tong**, Queen's University*
***Jack van Rijswijck**, University of Alberta*
***Ljiljana Velisavjlevic**, York University*
***Raman Verma**, University of Western Ontario*
***Qi Wang**, McGill University*
***Xiong Wei**, University of British Columbia*
***Xiaojing Wu**, University of British Columbia*
***Xiaomeng Wu**, University of Alberta*
***Peter Yap**, University of Alberta*
***Xiaodong Zhou**, University of British Columbia*
***Yuliang Zhu**, York University*

Anthony T. Eyton, President and CEO of Precarn and Director of IRIS, said, "We are committed to creating job opportunities for highly-skilled Canadians right here at home, and these funds will go a long way in helping to address Canada's 'brain drain' and skills shortage challenges. The work of these Precarn Scholars - who are some of the best and brightest in their fields - will in turn help keep robotics and IS at the forefront of the Canadian economy, boosting the productivity and competitiveness of industries across the map while delivering numerous social benefits at every level, including healthcare, security, the environment and entertainment."

IRIS RESEARCH PROGRAMS

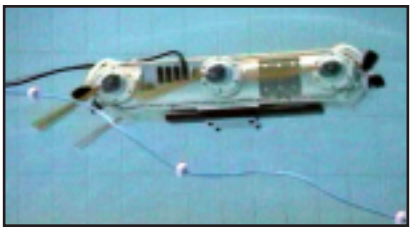
2002-2003 was the first full year in this current phase of IRIS funding. In the 18 Core Projects each had a start date of April 2002 and have an expected completion date of March 2005. Progress continued to be made in these projects that represent the main focus of the IRIS Research Program. They are funded at a level of $4.73 million and comprised of over 90 researchers and over 100 graduate students, post-doctoral Fellows and research associates from 16 different universities across Canada and 2 in the United States.

Core Research Program

AQUA
Autonomous Aquatic Walking Robot

Goal: This project team is investigating fundamental issues related to locomotion, sensing, navigation and reasoning for underwater autonomous vehicles. Specifically, they are focusing on aspects of intelligent systems as applied to autonomous aquatic vehicles that utilize both reaction against the surrounding water (thrusters, propellers, control surfaces) as well as walking (limbed) locomotion.

***Status*:** Most of the sensor hardware package has been constructed, and underwater tests conducted in the summer of 2003. As well, the team is developing a modeling and test setup for characterizing and optimizing robot legs that serve equally well as aquatic flippers and terrestrial legs. For this purpose a complete test and data acquisition test bed has been set up. The prototype robot has been waterproofed and the first underwater test runs are taking place.



RHex hexapod robot.

Principal Investigators

Prof. Michael Jenkin, York University (Project Leader)

Prof. Martin Buehler, McGill University

Prof. Gregory Dudek, McGill University

Prof. Evangelos Milios, Dalhousie University

Participants

Canadian Space Agency

MD Robotics

IRIS Contribution: $578,000

GEP
Intelligent Computational Methods for the Analysis of Gene Expression Profiles

Goal: This project focuses on the development of intelligent computational support for analyzing and interpreting genomic datasets, with a focus on SAGE (serial analysis of gene expression) and microarray data from two specific problem domains: i) gene expression profiles used to obtain markers for cancer, ii) phylogenetic classification in the context of studying microbial communities containing large numbers of yet unknown organisms.

Status: The team has made progress on several fronts. They have implemented a biological data warehouse: that is, they have integrated distributed biological databases and biological datasets (microarray and protein interaction, both human and model organisms) using DB2 and IBM Discovery Link. The resource is used during analysis, visualization and interpretation.

They have also extended their clustering algorithm (BTSVQ) with Expectation Maximization for improved analysis as well as their case-based reasoning system (TA3) with genetic algorithms to provide automated optimization of k-nearest neighbor matching. This has been tested on several microarray data sets. Finally, they have integrated the analysis, visualization and hypothesis generation using human microarray data from diverse cancers and putative database of protein interactions.

Principal Investigators

Prof. Igor Jurisica, University of Toronto (Project Leader)

Prof. Janice Glasgow, Queen's University

Prof. Holger Hoos, University of British Columbia

Prof. Raymond Ng, University of British Columbia

Participants

IBM Canada Ltd.

University Health Network

IRIS Contribution: $578,000

Screen shot of GEP software tool that presents microarray data analysis.

IRIS RESEARCH PROGRAMS

GestureCAM

Dynamic, Real-Time Hand Gesture Recognition with an Application to Camera System Control in a Distance-Learning Setting

Goal: GestureCAM focuses on the problem of distance learning, which is increasingly important for university courses, research seminars, continuing education/training and for connecting major centres and remote communities. This research intends to develop a gesture-based control language, used by speaker and audience, and recognizable by camera systems imaging speaker and audience, to enable multiple sites to benefit from a central lecturer and the active participation of multiple audiences without camera operators and crews.

Status: The researchers were contacted by the Canadian Hearing Society (Sudbury office) following an article on the project in *The Toronto Star*. They have 26 video-conference rooms in Ontario none of which are usable by the deaf/mute because the microphones are voice activated. They asked if the team could develop a gesture-activated system. Believing that this is quite do-able, the group is working on a demo.

Principal Investigators

Prof. John Tsotsos, York University (Project Leader)

Prof. Michael Jenkin, York University

Prof. Sven Dickinson, University of Toronto

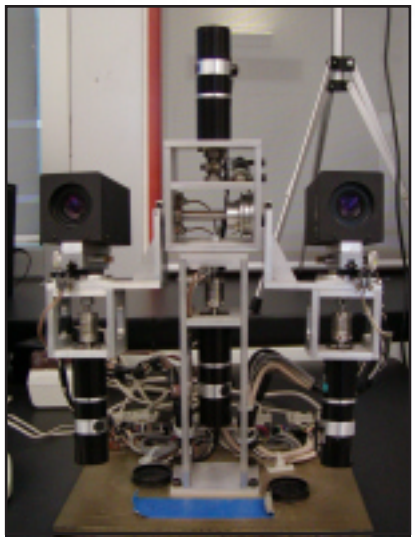
Prof. Richard Wildes, York University

Prof. Ronald Owston, York University

Participant

IBM Canada Ltd.

IRIS Contribution: $474,000



GestureCAM's SAVI (Stereo Action Vision Interface) system is able to detect face and hand gestures in a real world environment.

HI-VEC

Foundations of Haptic Interfaces for Virtual Environments and Communications

Goal: Haptic interface technologies refer to interactive user-machine communication established by way of mechanical signals. This project focuses on basic issues of haptic interface design. The four problems to be examined in this project are:

- The need for automatic determination of the parameters of haptic effects to users;
- The need to develop more general application programming interfaces with a richer set of primitives and efficient implementations;
- The need for an abstract "haptic language" able to articulate haptic signals that users can intuitively interpret, manipulate and create; and
- The need for new classes of devices that can go beyond point-like interaction paradigms, and are capable of distributed stimulation.

Status: Results to date include Professor Ellis (IT-MED project) and Professor Hayward collaborating on exploring a "tactile microscope" or "tactile stethoscope." That is, a hand-held instrument capable of amplifying certain aspects of tactile signals too weak to be perceptible with bare hands. This would have application in arthroscopy, first but in many other areas as well. Further, McGill researchers are negotiating a licensing agreement with a Montreal-based company to design a new Braille display technology based on the STReSS tactile display.

Principal Investigators

Prof. Vincent Hayward, McGill University (Project Leader)

Prof. Dinesh Pai, University of British Columbia

Prof. Susan Lederman, Queen's University

Prof. Tim Salcudean, University of British Columbia

Prof. Karon MacLean, University of British Columbia

Prof. Roberta Klatzky, Carnegie Mellon University

Participants

Cimmetry Systems, Inc.

Immersion Canada Inc.

Immersion Corporation

MPB Technologies Inc.

Quanser Advanced Control Systems

VisuAide Inc.

IRIS Contribution: $598,000

Daniela Constantinescu (UBC) explains her IS 2003 demo "Haptic Feedback using Local Models of Interaction" to Cyril Lunney of ASN-TV's Breakfast Television in Halifax.

IRIS RESEARCH PROGRAMS

IACCG
Intelligent Agents in Commercial Computer Games

Goal: The objective of this project is to create non-player characters (NPC) that exhibit realistic, human-like behaviour. This involves creating "black box" artificial intelligence systems for NPCs. The idea is to develop the core technology and separate it from the rest of the application.

Status: While researching new ways for creating adaptive characters, the team at the University of Calgary built a tool that is useful for testing. The tool identifies patterns in the Electronic Arts FIFA soccer game that result in the opponent scoring a goal. The original research objective here was to use this information to modify the players so that the same mistake does not recur. Instead, the tool can be used to identify frequently occurring mistakes. The end result is to make the game smarter and more intuitive.

Principal Investigators

Prof. Jonathan Schaeffer, University of Alberta (Project Leader)

Prof. Jorg Denzinger, University of Calgary

Prof. Russell Greiner, University of Alberta

Prof. Rob Holte, University of Alberta

Prof. Martin Mueller, University of Alberta

Prof. Duane Szafron, University of Alberta

Participants

BioWare Corp.

Electronic Arts (Canada) Inc.

IRIS Contribution: $472,000

IACCG - Screen shot from a role-playing game testbed.

IT-MED
Intelligent Tools for Medical Diagnosis and Intervention

Goal: Medical personnel face revolutionary advances in computing, imaging and intervention techniques, but lack the proper technical infrastructure and ergonomic tools that would allow them to fully exploit these advances. This project proposes to address the need for better systems to acquire medical images, process them and build models from them. It also addresses the need for ergonomic interfaces and effective training systems.

Status: A demonstration volume was captured at GE world-wide X-ray headquarters. The researchers have subsequently extracted digitally reconstructed radiographs that provide excellent simulation of 2D X-ray images. A new haptic device (without force feedback) developed by the McGill researchers to provide shape display is under construction.

Principal Investigators

Prof. Tim Salcudean, University of British Columbia (Project Leader)

Prof. Randy Ellis, Queen's University (Project Co-Leader)

Prof. Shahram Payandeh, Simon Fraser University (Project Co-Leader)

Prof. John Dill, Simon Fraser University

Prof. Vincent Hayward, McGill University

Prof. Peter Lawrence, University of British Columbia

Prof. Christine MacKenzie, Simon Fraser University

Prof. James McEwen, University of British Columbia

Prof. Ash Parameswaran, Simon Fraser University

Participants

AVAYA Canada

Delfi Medical Innovations Inc.

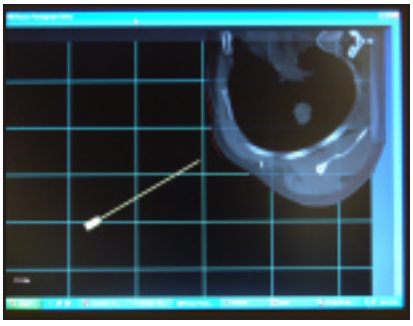
GE Medical Systems Canada

IBM Canada Ltd.

Neil Squire Foundation

Quanser Advanced Control Systems

IRIS Contribution: $900,000



Simulation of needle insertion into soft tissue.

KMS
Knowledge Management and Service Provision for Mobile Users

Goal: The main objective of the project is to develop some of the missing technologies that will deliver desired information and services to mobile users. The three types of technologies that will be researched are:

- Technologies that facilitate the development of wrappers for heterogeneous, distributed data sources;
- Technologies that support the reengineering of existing data sources and legacy code so that they can be accessed as data and services by mobile users;

IRIS RESEARCH PROGRAMS

KMS (CONT'D)

- Technologies that support the run-time, dynamic creation of wrappers and services in response to user queries.

Status: Highlights of the project include: the implementation of a system that allows for the creation of context-aware data and service provision so that data items can be associated at run time with various services and access permissions, according to the context they are accessed on. The University of Waterloo team is in contact with the Bell University Laboratories group to identify deployment opportunities for the prototype system in the area of the customizable dissemination and usage of medical data (patient records and medical updates) by various expert groups (nurses, doctors, epidemiologists) during hospital or in-house treatment. The University of Toronto team is completing the prototype system. The system answers clinical questions using high quality evidence-based medical resources, that report on clinical information and summarize the quality of the evidence about the information. Questions and answers are both understood in terms of a lightweight ontology of evidence-based medicine. This allows questions to be answered based on the semantic relationship between questions and answers, which is key to ensuring high precision and recall.

Principal Investigators

Prof. John Mylopoulos, University of Toronto (Project Leader)

Prof. Kostas Kontogiannis, University of Waterloo

Prof. Eleni Stroulia, University of Alberta

Participants

Alberta Software Engineering Research Consortium (ASERC)

Bell Canada

IBM Canada Ltd.

IRIS Contribution: $400,000

LEARN
Learning Algorithms

Goal: Learning algorithms are mathematical and computational tools that extract useful information from data. They are useful when we don't have a complete and exact theory about the source of the data, but we must rely on the data itself to infer knowledge about its distribution or about good decision strategies. The main objective of this project is to improve statistical learning algorithms so that they can face the challenges posed by their applications to data-mining (including applications in the pharmaceutical and services industries). The project will work on improvements in the following directions:

- how to deal in a computationally efficient way with a large number of records, especially when the number of variables (dimensions) is large;
- how to mine useful information about the structure and function of molecules, using different sources of information;
- how to deal with highly unbalanced distributions of data (as can be found in data mining applications); and
- how to deal with outliers (e.g. large values) in the data?

Status: In the area of statistical learning algorithms for high-dimensional data, the researchers have started a sub-project in collaboration with a new partner, Idilia Inc., that will apply previous work on the use of neural networks for probabilistic language modeling. This ties in with the language processing progress made in applying unsupervised learning to collaborative filtering in which informative queries are selected to make better recommendations for a given user. As well, a new unsupervised learning method (multiple cause vector quantization) has been extended to hierarchical representations, and is being applied to facial expression images. The method learns classes corresponding to expressions, and also finds other latent categories, such as gender.

Principal Investigators

Prof. Yoshua Bengio, Université de Montréal (Project Leader)

Prof. Luc Devroye, McGill University

Prof. Balazs Kégl, Université de Montréal

Prof. Francois Major, Université de Montréal

Prof. Richard Zemel, University of Toronto

Prof. Sam Roweis, University of Toronto

Participants

Bell Canada

Idilia Inc.

Merck Frosst Canada Ltd.

IRIS Contribution: $495,000

MIL-2
Practical Applications of Advanced Mixed Reality Display and Audio Signal Processing Concepts

Goal: An almost universal feature of human-machine interface (HMI) technology development is the exclusive involvement of information technology, computer science, software and traditional engineering disciplines - with early involvement of human factors experts and/or behavioural scientists being more of an exception than the rule. The result is difficult to use, and often ineffective, HMI's. The general goal of this project is to apply the team's extensive knowledge of human physiology and perception, both visual and auditory, as the driving factor in a series of novel HMI design concepts.

IRIS RESEARCH PROGRAMS

MIL-2 (CONT'D)

Status: The researchers have found that the relative location and the degree of directionality of a pair of microphones can greatly influence one's ability to locate and enhance signals coming from particular sound sources in a complex and reverberant environment. They have been investigating the effects of varying the degree of directionality between the two members of a microphone pair, and the effects of this on sound localization. The idea is that low frequencies can be located by using time differences between the two microphones, while the location of high frequency components of the stimulus are determined by using intensity differences that are a function of the degree of directionality of the microphone. The problem is that using two highly directional microphones gives more accurate localization, but also distorts the signal. They are investigating the effects of having one highly directional microphone (which can give some location information) and another less directional microphone in which the signal is relatively undistorted. They are also investigating the efficacy of using two microphones with different degrees of directionality. In the one case, information that is more useful for localization is provided, and from the second, less directional microphone, you get less distortion in the speech signal.

Principal Investigators

Prof. Paul Milgram, University of Toronto (Project Leader)

Prof. Barrie Frost, Queen's University

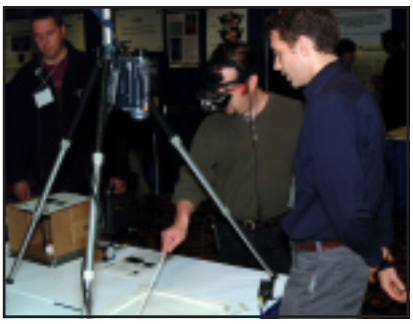
Prof. Max Cynader, University of British Columbia

Participants

Transport Canada

Wavemakers Research Inc.

IRIS Contribution: $492,000



PHERST (Predictive and Historical Extrapolated Reality Display System) is demonstrated at IS 2003 in Halifax.

NFDM

New Frontiers in Data Mining

Goal: This project will open new frontiers in data mining, by developing foundations and technologies for querying, analyzing and mining novel forms of data. For example, data on the web, for mining novel kinds of patterns - e.g. analyzing XML data to discover schema, and analyzing transactional data to discover actionable rules which have a more direct impact on business - and for unifying the apparently different fields of data mining and OLAP.

Status: As a result of the success of the work done in the project, the researchers have been able to attract the interest of a number of organizations. Current industry partners IBM Canada Toronto Lab and IBM Canada Pacific Development Center have been pleased with the progress and continue to work closely with the team. In addition, the research team has also been collaborating with HP Labs, London Drugs and the Alberta Research Council on further R&D efforts.

Principal Investigators

Prof. Laks Lakshmanan, University of British Columbia (Project Leader)

Prof. Jiawei Han, Simon Fraser University

Prof. Alberto Mendelzon, University of Toronto

Prof. Raymond Ng, University of British Columbia

Prof. Ke Wang, Simon Fraser University

Participants

IBM Canada Ltd.

IRIS Contribution: $450,000

PDCA

Parallel Distributed Camera Arrays for Intelligent Environments

Goal: This project will explore large, parallel, distributed arrays of inexpensive cameras with image processing for use in intelligent environments. The project aims to develop large, reconfigurable, scalable camera arrays with onboard image processing, and techniques for cooperative, parallel distributed image processing suitable for high resolution images.

Status: The testing of a smart-camera processing unit has begun. In addition, the group has developed a number of applications of smart camera technologies focused on eye contact sensing, such as people looking at the device or at each other, as

IRIS RESEARCH PROGRAMS

PDCA (CONT'D)

well as an attentive videoconferencing system that communicates eye contact over the Internet through video images, optimizing bandwidth on the basis of the joint attention of users.

Principal Investigators

Prof. Jeremy J. Cooperstock, McGill University (Project Leader)

Prof. James J. Clark, McGill University

Prof. Sidney S. Fels, University of British Columbia

Prof. Roel Vertegaal, Queen's University

Participants

Celoxica Inc. - Americas Region

IBM Almaden Research Center

Xilinx Technologies Corp.

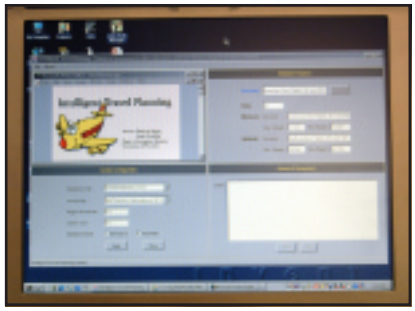
IRIS Contribution: $573,000

PREFELIC

AI Techniques for Preference Elicitation and Interactive Decision Making

Goal: The general objective of the project is to develop preference elicitation techniques of various forms that interact intelligently with the decision process. Specifically, given certain information about a user, a decision support system must derive an estimate of the user's utility function, determine whether to make a decision based on this estimate, and if not, determine what further information should be obtained about the user (directly from the user or otherwise) in order to improve decision quality.

Status: The integration of preference elicitation strategies with constraint satisfaction, begun in a new collaboration between the Toronto and Waterloo nodes last quarter, has proven extremely fruitful. Progress has been swift, and this technology is showing early signs of commercial promise.



Screen shot of an interactive decision-making system for airline travel.

Principal Investigators

Prof. Craig Boutilier, University of Toronto (Project Leader)

Prof. Fahiem Bacchus, University of Toronto

Prof. Holger Hoos, University of British Columbia

Prof. Grigoris Karakoulas, University of Toronto

Prof. David Poole, University of British Columbia

Prof. Dale Schuurmans, University of Waterloo

Prof. Qiang Yang, Simon Fraser University

Participants

CIBC

IRIS Contribution: $495,000

REALITY

Reality-Based Modeling and Simulation of Physical Systems in Virtual Environments

Goal: REALITY will develop a comprehensive suite of methods for acquiring and simulating multimodal models including: sound, contact textures and forces, deformations, reflectance properties, animation models, internal structure, and cutting behaviour. These models are of utmost importance for Canadian industry in the areas of computer special effects, computer games and animation, surgical simulation, auditory and haptic interfaces, and telerobotics.

Status: Among the accomplishments of the researchers was the construction of a low-cost 122 million pixel camera. This camera has been tested and was demonstrated at the IS 2003 conference. As well, the researchers have had many papers on their work accepted at major international conferences.

Principal Investigators

Prof. Wolfgang Heidrich, University of British Columbia (Project Leader)

Prof. Uri Ascher, University of British Columbia

Prof. Vincent Hayward, McGill University

Prof. Michiel van de Panne, University of British Columbia

Prof. Robert Woodham, University of British Columbia

Participants

Critical Mass Labs

Electronic Arts (Canada) Inc.

MD Robotics

Point Grey Research Inc.

Radical Entertainment

IRIS Contribution: $600,000

EigenSkin: Real time large deformation character skinning in hardware.

IRIS RESEARCH PROGRAM

RoPar

Robot Partners: Visually Guided Multi-Agent Systems

Goal: This project is based on designing and implementing collaborative robotic systems. It will extend the strong base in sensor-based robotics by evolving the specification, design and implementation of collaborative robotic systems. The goal is to develop new stochastic frameworks for constraint-based design of embedded intelligent systems and techniques. This will help in the understanding and integration of models of behaviour with information acquisition to build responsive collaborative collections with vision-based agents.

Status: At IS 2002, attendees were greeted by José, a robotic waiter and test bed developed by the group at UBC. This year, ERIK, the next generation robot was presented at IS 2003. ERIK represents a significant advance over José with increases in processing power, perception and mobility.

Principal Investigators

Prof. James Little, University of British Columbia (Project Leader)

Prof. James Clark, McGill University

Prof. Nando de Freitas, University of British Columbia

Prof. David Lowe, University of British Columbia

Prof. Alan Mackworth, University of British Columbia

Participants

Cellula Robotics Ltd.

MD Robotics

Point Grey Research Inc.

IRIS Contribution: $600,000

Graduate student Pantelis Elinas of UBC demonstrates "ERIK" to media at IS 2003 in Halifax. ERIK perceives his surrounding environment using volume maps constructed with his stereo vision system and interacts with people using speech and facial expressions.

TAIMS

Transparent Adaptation in Intelligent Multimodal Human-Machine Systems

Goal: Interface transparency occurs when the user's efforts are entirely directed at a task, and not at the interface that supports that task. This project takes the first step towards a well-grounded and systematic foundation for transparent adaptive interface design. The project will deliver a) a systematic study of the concept of adapting multimodal user feedback at fast perceptual rates, through iterative prototyping and performance evaluation in several test domains; b) systematic design guidelines and insights; c) coordinated perceptual data on intramodal processing limits; and, d) a flexible, extendable, inexpensive real-time platform easily reproduced and possibly unique worldwide in capability.

Status: In collaboration with industry partner Nissan, the group supervised by Dr. MacLean has implemented Nissan's concept of haptic potential force feedback supplied through an automobile pedal in an in-house developed driving simulator in Professor MacLean's SPIN lab. The potential force provides a force push-back on the pedal when the driven vehicle approaches a leading car too closely.

Principal Investigators

Prof. Karon MacLean, University of British Columbia (Project Leader)

Prof. Kathleen Akins, Simon Fraser University

Prof. Cristina Conati, University of British Columbia

Prof. Michael Feeley, University of British Columbia

Prof. Sidney Fels, University of British Columbia

Prof. Ronald Rensink, University of British Columbia

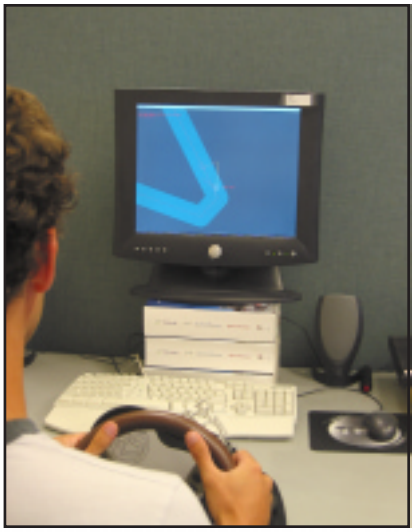
Participants

Immersion Corporation

Nissan Research Center

Tactex Controls Inc.

IRIS Contribution: $500,000



A user interacting with a simple driving simulator via a modified consumer force feedback steering wheel. Intelligent guiding forces are applied to the steering wheel when the system detects that the vehicle will leave the road.

IRIS RESEARCH PROGRAMS

TRA
Acquisition, Querying and Prediction of Motion Trajectories

Goal: Situation awareness is recognized as a critical factor in the performance of humans, as well as of interactive intelligent systems, over a range of tasks including sports and entertainment, aircraft piloting, air traffic control, automobile driving, as well as other surveillance applications (e.g. airports). To enhance the situation awareness of intelligent systems via the perception of motion, this project will collect and analyze massive amounts of motion trajectory data so as to provide an appropriate interpretation of a situation.

Status: Currently under testing, the researchers have developed a similarity metric, based on moving direction and moving distance ratio, which is invariant to spatial scaling, shifting and rotating. When people compare two trajectories, they check the moving directions and the moving distances under each direction. In most of the cases, moving directions are more important than moving distances. If two objects move in different directions but with the same distance, it is quite intuitive to determine that these two trajectories are not similar. The similarity metric for trajectories is designed based on these observations, which is very close to perceptions of humans.

Principal Investigators

Prof. Raymond Ng, University of British Columbia (Project Leader)

Prof. Jeff Boyd, University of Calgary

Prof. James Little, University of British Columbia

Prof. David Lowe, University of British Columbia

Prof. Michael McAllister, Dalhousie University

Prof. Tamer Ozsu, University of Waterloo

Prof. Robert Woodham, University of British Columbia

Participants

Electronic Arts (Canada) Inc.

IBM Almaden Research Center

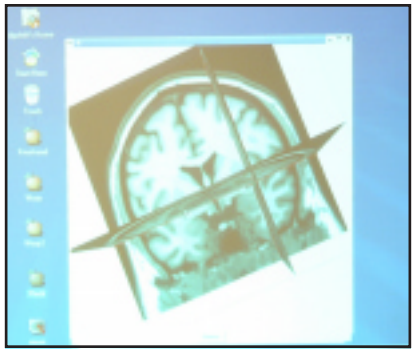
Point Grey Research Inc.

IRIS Contribution: $572,000

TULIP
Three-Dimensional Ultrasound for Image-Guided Procedures

Goal: The thrust of this work is on developing 3D Ultrasound systems to complement image-guided surgical procedures in the brain and the breast. At the project's end, the plan is two-fold. First, to demonstrate a clinically evaluated image-guidance system, that combines 3D intra-operative ultrasound with pre-operative MRI, and that automatically updates the pre-op MR image to reflect current intra-op brain morphology. Second, it is expected to have a clinical prototype breast biopsy system completed and tested.

Status: The project has demonstrated that the 3D ultrasound system and stereo x-ray mammography can be integrated into one system. It is believed that this is the first system of this kind in the world and was reported at the 2003 SPIE-Medical Imaging International Symposium.



IS 2003 demo "Brain Surgery and Breast Biopsy: 3D Ultrasound Image Guidance" showed developments of TULIP research. Rapidly updated 3D ultrasound images are fused with MRI images for intraoperative image guidance in neurosurgery, and with x-ray mammograms for accurate guidance for breast biospies.

Principal Investigators

Prof. Terry M. Peters, John P. Robarts Research Institute (Project Leader)

Prof. Aaron Fenster, John P. Robarts Research Institute

Prof. Louis Collins, McGill University

Prof. Robert Rohling, University of British Columbia

Participants

Atamai Inc.

Ultrasonix Medical Corporation

IRIS Contribution: $578,000

VISTA
Visual Intelligence for Surveillance and Telepresence Applications

Goal: The main objective of this project is to better understand human visual attention, to use this knowledge to guide the design of better visual interfaces and to build attentive machine vision systems useful for applications in surveillance and teleconferencing.

Status: The York researchers have completed the second generation prototype of a foveated panoramic sensor. This second generation compact artificial visual system is useful for surveillance, remote learning, teleconferencing, and other applications. The system was demonstrated at IS 2003 in Halifax. Also, as a result of expertise gained from this project, Professor Elder is participating in the Precarn University-Led MONNET project.

Principal Investigators

Prof. James Elder, York University (Project Leader)

Prof. James Clark, McGill University

Prof. John Tsotsos, York University

Participants

CRESTech

VisionSphere Technologies

IRIS Contribution: $600,000

FINANCIAL STATEMENTS

For Institute for Robotics and Intelligent Systems

For year ended March 31, 2003

These financial statements have been extracted from the audited financial statements of Precarn Incorporated (May 2003) and from the auditors' report on IRIS' compliance with Networks of Centres of Excellence funding agreements (July 2002). These reports are available upon request from the Precarn office.

Statement of Financial Position
March 31, 2003

	2003	2002
CURRENT ASSETS		
Cash	$ 939,519	$ 195,414
Accounts receivable	-	353
Prepaid expenses	16,257	12,845
	955,776	**208,612**
CURRENT LIABILITIES		
Accounts payable and accrued liabilities	$ 17,244	$ 26,550
Owing to Precarn Incorporated	-	-
Deferred revenue IRIS	757,492	16,748
	774,736	43,298
UNRESTRICTED NET ASSETS	181,040	165,314
	$ 955,776	**$ 208,612**

Deferred Revenue
year ended March 31, 2003

	2003	2002
Balance at beginning of year	$ 16,748	$ 7,143
Contributions received from NSERC in year	4,730,000	4,200,000
Excess project funding repaid in the year	18,809	65,050
Less amount recognized as government assistance in year	(4,008,065)	(4,255,445)
BALANCE AT END OF YEAR	**$ 757,492**	**$ 16,748**

(Extracted from the audited financial statements of Precarn Incorporated for the year ended March 31, 2003 with a reporting date of May 14, 2003. These statements are available upon request.)

Summary of Contributions from NCE and Other Sources
year ended March 31, 2003

	Cash	In-Kind/Industry
NCE AWARD	$ 4,730,000	$ -
University	$ -	$ -
Industry	331,245	44,100
Provincial	65,194	-
Federal	-	8,000
Other Sources	48,796	-
NON-NCE CONTRIBUTIONS	445,235	52,100
	$ 5,175,235	**$ 52,100**

(The amounts received from non-NCE contributors are as reported by the projects and therefore have not been audited.)

FINANCIAL STATEMENTS

Statement of Operations and Changes in Net Assets

year ended March 31, 2003

	2003	2002
REVENUES		
Government assistance - NSERC	$ 4,008,065	$ 4,255,445
Interest earned and other revenue	81,244	57,670
	4,089,309	4,313,115
EXPENSES		
Projects (Schedule A)	$ 3,358,064	$ 3,591,960
Operating (Schedule B)	407,806	383,882
Networking (Schedule B)	104,232	171,978
Conference (Schedule B)	203,481	166,586
	4,073,583	4,314,406
NET INCOME (EXPENSE)	15,726	(1,291)
UNRESTRICTED NET ASSETS AT BEG OF YEAR	165,314	166,605
UNRESTRICTED NET ASSETS AT END OF YEAR	**$ 181,040**	**$ 165,314**

Schedule of Project Expenses (Schedule A)

year ended March 31, 2003

	2003	2002
University of Alberta	$ 157,300	$ 39,274
University of British Columbia	1,264,158	921,102
C-CORE	-	14,499
University of Calgary	51,700	-
Concordia University	-	41,500
Dalhousie University	51,500	20,000
Université Laval	-	275,332
University of Guelph	-	8,499
University of Manitoba	-	50,001
McGill University	495,100	280,201
McMaster University	-	66,000
Memorial University	-	15,000
École Polytechnique de Montréal	-	152,744
Université de Montréal	93,000	128,827
University of Ottawa	-	14,001
Queen's University	218,807	188,001
John P. Robarts Research Institute	105,166	28,500
University of Regina	-	73,250
University of Saskatchewan	-	44,001
Simon Fraser University	133,000	210,501
University of Toronto	390,333	408,501
University of Victoria	-	195,600
University of Waterloo	79,000	185,726
University of Western Ontario	-	54,399
University of Windsor	-	14,001
York University	319,000	162,500
TOTAL PROJECT EXPENSES	**$ 3,358,064**	**$ 3,591,960**

(Extracted from the audited financial statements of Precarn Incorporated for the year ended March 31, 2003 with a reporting date of May 14, 2003. These statements are available upon request.)

FINANCIAL STATEMENTS

Schedule of Operating, Networking and Conference Expenses (Schedule B)

YEAR ENDED MARCH 31, 2003

	2003	2002
OPERATING EXPENSES		
Salaries and benefits	$ 307,504	$ 300,972
Professional fees	5,950	16,420
Supplies and other	56,316	7,208
Communications	6,821	5,327
Equipment service contracts	23,615	44,459
Conference and associations	4,198	7,548
Insurance	3,402	1,948
	407,806	**383,882**
NETWORKING EXPENSES		
Technology transfer	10,532	69,251
Meetings	20,199	25,614
Travel	29,980	14,598
Public relations and printing	43,521	62,515
	104,232	**171,978**
CONFERENCE EXPENSES		
Travel	32,931	28,602
Communications	10,013	6,000
Receptions	28,690	28,478
Student prizes and demos	4,000	4,000
Miscellaneous	3,838	3,007
Meeting room rental	68,244	61,780
Public relations and printing	21,525	20,625
Speaker expenses	34,240	14,094
	$ 203,481	**$ 166,586**

Statement of Cash Flows

YEAR ENDED MARCH 31, 2003

	2003	2002
CASH PROVIDED FROM (USED BY)		
OPERATING ACTIVITIES:		
Net income (expense)	$ 15,726	$ (1,291)
CHANGES IN NON-CASH WORKING CAPITAL COMPONENTS:		
Accounts receivable	353	-
Prepaid expenses	(3,412)	3,041
Accounts payable and accrued liabilities	(9,306)	(76,027)
Owing to Precarn Incorporated	-	(24,891)
Deferred revenue	740,744	9,605
INCREASE IN CASH	744,105	(89,563)
CASH AT BEGINNING OF YEAR	195,414	284,977
CASH AT END OF YEAR	**$ 939,519**	**$ 195,414**