Annual Report

2005 - 2006

Professor Gregory Dudek
Director

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Director's Comments

On January 1, 2005, I became the Director of the Centre for Intelligent Machines. My journey to CIM began in 1991 -- as a freshly graduated PhD in Computer Vision at U of T, I joined Professors Martin Levine and Steven Zucker in the Vision Lab of CIM, went on to hold an adjunct professorship in the Department of Electrical Engineering and later became a full member of the School of Computer Science.

I was attracted to the Centre because of its unique qualities -- an interdisciplinary environment where a commitment to collaboration and cross-fertilization of ideas was foremost. At that time, this concept was considered almost radical and certainly unsustainable by traditional learning institutions throughout Canada and abroad.

CIM reached an unprecedented benchmark this year - our Centre celebrated its 20th Anniversary. In reflecting on this annual report for 2005 - 2006, I am exceptionally proud to say that CIM's drive to remain unique and truly multidisciplinary is as strong as ever. Our sense of place – who we are and how we got here -- is one of our defining characteristics. The role that we have played in the McGill community cannot be overstated.

Our Centre's accomplishments are as much about the quality of the people who have walked these corridors as it is about the delivery of leading research and innovation. Our 20th Anniversary Celebration provided an ideal opportunity for us to pay tribute to our fearless founders for their willful characters and undeniably ambitious objectives.

We are grateful to our university, and specifically the Faculty of Engineering, for having the courage 20 years ago to carve out a place for a research intensive centre where students and researchers of many disciplines could work side-by-side.

Our appreciation is also extended to the Faculty of Science and the School of Computer Science for their ongoing support and in particular for their significant contribution to the design and maintenance of our new website.

CIM has achieved international status and has justly earned a reputation for excellence and diversity in research and education. We remain unique in Canada for both our interdisciplinary synergy and our leadership in the robotics domain. One of our greatest achievements as a community is our spirit to excel. While already successful, our community refuses to rest on its laurels. We are working with renewed enthusiasm to set higher goals and standards for multidisciplinary research initiatives in the years ahead.

Gregory Dudek
Director

Marlene Gray
Manager

Background Summary

Mission
The Centre for Intelligent Machines (CIM) supports graduate research, teaching and applications of intelligent systems. This dynamic community of scientists, engineers and designers seek to bridge science and innovation. Their novel ideas bring solutions to some of the most challenging problems of the 21st century.

Established in 1985
CIM was formed in 1985 as the McGill Research Centre for Intelligent Machines (McRCIM). At that time, it reported to the Dean of the Faculty of Engineering and the Vice-Principal Graduate Studies and Research. Members from the Departments of Electrical Engineering, Mechanical Engineering, the School of Computer Science, Biodmedical Engineering and Mining and Materials Engineering contributed to the Centre's early formation.

As of 2006
Today, the Centre is comprised of over 25 faculty members and associate members, 150 graduate and honours-undergraduate students, post-doctoral fellows and visitors and 13 topical laboratories. The Centre for Intelligent Machines currently spans 2 faculties with members from the Departments of Electrical and Computer Engineering, Mechanical Engineering and the School of Computer Science. It also has associate members and collaborators in related disciplines, such as the Montreal Neurological Institute, and other universities both within Québec and Canada.

Research Objectives
Our fundamental research objectives and philosophy have remained the same for over 20 years – to push forward the boundaries of intelligent systems through scientific discovery and to educate new generations of students to apply this knowledge to the development of technologies that address the complex needs of modern society.

Research Themes
The main research themes within the Centre are:

- Artificial perception
- Robotics
- Systems and control
- Human-Machine interfaces

Interactive Environment
The operation of the Centre is driven by our collective needs with an eye towards synergy and economies of scale. Resources are fully shared among all users in the CIM community. This open, collaborative environment encourages academic debate and the free exchange of ideas.

Academic Recruitment
CIM's global reputation as a dynamic and multidisciplinary research environment has attracted the interest of many top scientists. Since 1998 alone, 12 academic hires in the Faculties of Science and Engineering accepted positions at McGill largely because of the presence of the Centre and the opportunity to interact with CIM members.

Funding Diversity
We have been successful over the years in attracting funding from numerous sources: NSERC, NCE, CFI, FQRNT, DRES, DARPA, Canadian, U.S. and foreign industries. We have used this funding, in part, to support the acquisition of state of the art research facilities.

Physical Resources
The physical resources of CIM comprise about 14,000 sq. ft. in the McConnell Engineering Building on McGill's main campus. This represents a nearly contiguous collection of offices, laboratories, a small meeting room and space dedicated to house an extensive information system. This proximity creates a working community where we naturally and regularly meet and interact with each other.

Laboratories
Our diverse research culture is home to 13 interdisciplinary laboratories specializing in the areas of:

- Robotics
- Mechatronics
- Aerospace
- Systems and Control
- Haptics
- Vision
- Medical Imaging
- Shared Reality

Objectives in 2005-2006

- Promote the Centre locally, nationally and internationally for its rich multidisciplinary history and its impressive achievements in the study of intelligent systems, the quality of its research and its important role in the greater McGill community.

- Celebrate the Centre's accomplishments over the past 20 years. Create a unique forum that will bring together our students and faculty of past generations and our current CIM community to share knowledge and experiences.

- Push our intellectual boundaries, explore new research programs that provide enormous potential for collaboration, notably biomedical engineering, ultra-videoconferencing, biological sciences, and music.

- Emphasize excellence in teaching and research as both dynamic and interactive processes.

- Seek diversified funding sources and continue to deliver leading-edge solutions to industry problems.

INITIATIVES AND INNOVATION

- **CIM 20TH ANNIVERSARY CELEBRATION AND SYMPOSIUM**

On May 26, 2006, our Centre celebrated 20 years of research excellence.

The day's activities included alumni reunions, special guest speakers, a student Poster Session and an Open House. The Anniversary Celebrations were capped off by a special dinner at the Faculty Club to honor our alumni.

Our special guest speakers included:

> **Dr. Steven W. Zucker**, CIM co-founder and David & Lucile Packard Professor at Yale Professor
>
> **Dr. Alex (Sandy) Pentland,** Toshiba Professor of Media Arts and Sciences at MIT
>
> **Julie Payette**, CSA/NASA Astronaut, Mission Specialist on Discovery STS-96 May 1999 launch and former PhD candidate at CIM.

The entire day was dedicated to both current and former students and academic members of CIM. It was also a celebration of extraordinary research and science shared with the entire McGill community.

To accomplish a task of such breadth and reach, we:

1. **Assembled former alumni of the Centre, many of whom were students during the 1980's and 1990's.** Reinforced our relationships with our former students, and provided networking opportunities for our current students.
2. **Celebrated our history with several generations of CIM students and faculty**. Scheduled special speakers from our alumni ranks who shared personal experiences and business savvy with our current students.
3. **Recognized our accomplishments and contributions to science and engineering**. We hosted special scientific talks by former faculty members.
4. **Challenged our students to present their impressive research results in a Poster Session judged by a panel of accomplished former CIM students**. We announced the winners to an audience comprised of scientists, industrial officials and the general public.
5. **Welcomed undergraduate design students into our CIM labs** to share their passion and expertise with our CIM graduate students during our Open House.

On a personal level we gained a profound understanding and appreciation of our Centre's history. We learned that our community is as much about the extraordinary people who walk the halls of CIM as it is about the superb science. Over the past 20 years -

> CIM has made a vital contribution to the university's mission of excellence in teaching and research.
>
> CIM has nurtured a pioneering spirit and fearless ambition to be innovative, curiosity-driven and relevant to society.
>
> CIM has demonstrated a strong commitment to provide an outstanding research environment where graduate students, and their research studies, have flourished for more than 2 decades.

The CIM 20th Anniversary Celebration and Symposium was a major success: over 350 people from McGill and the general public attended the speaker sessions, 30 scientific posters were displayed and reviewed, about 100 visitors dropped by CIM and the Open House during the day and almost 100 people, including 60 alumni, attended the dinner engagement in the evening. Feedback received from our attendees was both positive and enthusiastic.

- **http://www.cim.mcgill.ca – A FRESH LOOK**

In recognition of the fact that the web is a primary conduit for outreach to both the outside world and the internal community, we thought it was time to update the appearance and functionality of our web presence.

The recently-revamped CIM web site provides the Centre with a fresh and technically relevant visage for the internet. The site now offers a cleaner design that allows most content to be reached with fewer clicks (and important metric for web site usability). It also includes dynamically updated content, collaborative management ("CMF") and content dependent control, for example showing certain items only on certain dates.

The new CIM web site is based on the Plone web development framework, which is in turn built on Zope and Apache. The server infrastructure hosting the site is being contributed in full to CIM by the School of Computer Science, which is also providing 24/7 on-call system management.

The technology includes a state-of-the-art modular framework with fine-grained security control and several impressive features including skinning, rollback support, and through-the-web editing. The site design and configuration, which has an estimated value in excess of $15,000, was performed by Christine Dudek and contributed to the Centre.

In addition to the ongoing infrastructure, the School of Computer Science provided an ensemble of tools and templates that they purchased and developed, and for which they have full IP rights.

- **NEW SIGNAGE FOR OUR CENTRAL DISPLAY AT CIM**

Combined with the upgrade of our website, we invested in a technologically superior central signage initiative. The CIM Video Kiosk is funded by a $10,000 grant from PRECARN, under the IRIS Programs for Knowledge Exchange and Technology Transfer.

The Kiosk display consists of two parts - a 46" NEC LCD flat panel display (model number LCD4610), and a 17" Trilogy Touch Technology touch screen. The displays will be driven by a Lenovo PC running Windows.

Initially the presentation will be displayed using a set of html (web) pages displayed using the Firefox browser in full screen mode, with the touchscreen mirroring the large display. The html presentation files are developed using Adobe GoLive. We also plan to upgrade the presentation to make use of the XPresenter software from X20 Media, which is a Powerpoint-based solution that will allow the showing of video feeds provided by external sources, particularly those provided by the University.

- **2005 YOUNG INNOVATOR OF THE YEAR AWARD**
  NETWORK OF CENTRES OF EXCELLENCE PROGRAMME
  GEOIDE (Geomatics for Informed Decisions) Network

We are proud to announce that Philippe Simard (BEng ’98, M Eng ’99, PhD ’03) and his brother Louis (BEng ’01,MEng ’03), won the Young Innovator Award from the GEOIDE Network in 2005. Both Philippe and Louis studied with Prof. Frank Ferrie, Director of the Artificial Perception Lab, before striking out as entrepreneurs and forming their company SimActive in 2003.

Philippe’s success with SimActive is another example of the entrepreneurial spirit that exists within our student community. Most of the thirty or so spin-off companies that CIM has spawned since 1985 are the direct result of students exploiting emerging technologies over the course of their studies.

SimActive has already collaborated with both government and industry in developing automated methods for generating accurate topological databases as well as designing a 3D modeling software for the camera system on the space shuttle Discovery.

The technology produced at SimActive is expected to benefit areas such as urban planning, disaster assessment and cartography.

HIGHLIGHTS

- **CIM FOUNDING MEMBER RECEIVES IEEE FELLOWSHIP**

We are extremely proud and honored by the recognition bestowed upon Prof. Jorge Angeles, who has been named a Fellow of the IEEE. The nomination was put forward by the Robotics and Automation Society. The grade of Fellow is awarded to engineers who have demonstrated outstanding proficiency and achieved distinction in their profession. The IEEE Grade of Fellow is conferred by the Board of Directors upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest.

Prof. Angeles is a full professor in the Department of Mechanical Engineering, founding member of the Centre for Intelligent Machines and Director of the Robotic Mechanical Systems Laboratory. He is also a member of the Royal Society of Canada, a holder of the NSERC Design Engineering Chair and a James McGill Professor. Congratulations Jorge!

- **NEW MULTIDISCIPLINARY COLLABORATION IN ROBOTICS AND THE MEDICAL SECTOR**

The year 2005-06 saw the birth of a new project, the SmartWheeler. This project is a semi-autonomous, sensor driven, power wheelchair which is designed to increase the autonomy and safety of individuals with mobility impairments.

A Freestyle F11 wheelchair, generously donated to the team by Sunrise Medical, was fitted with laser sweep sensors, wheel encoders, infrared sensors, onboard computation using the PC/104 form factor and numerous user input methods. The project's first year was devoted to the design of the platform, development of probabilistic planning algorithms to control the robot, and evaluation of input modalities.

While the project is still in its infancy, plans for the SmartWheeler include:

* Automatic mapping and localization of indoor/outdoor environments
* Detection and avoidance of positive and negative obstacles
* Point-to-point planning and navigation
* Shared control between autonomous controller and human user
* Adapted interface for low-bandwidth communication

The SmartWheeler project, led by Prof. Joelle Pineau and funded by the Canadian Foundation for Innovation, is a collaborative effort between researchers and students in the School of Computer Science, Department of Mechanical Engineering and the Department of Electrical and Computer Engineering of McGill University.

- **CREATION OF THE MEDICAL IMAGING LABORATORY**

The Medical Imaging Laboratory was formally created at CIM in October 2005 under the leadership of Prof. Tal Arbel. The MIL was funded in large part by a CFI grant and focuses on applications of research in computer vision to problems in medical imaging, with particular emphasis on building tools for image-guided neurosurgery and spinal surgery. The laboratory includes cutting-edge equipment found in modern operating rooms worldwide, including a portable ultrasound machine, a POLARIS tracking system and high-end workstations.

Research conducted in this lab is tied closely to the McConnell Brain Imaging Centre of the Montreal Neurological Institute and collaborators in the biomedical engineering and the neurology/neurosurgery sciences, Drs. Louis Collins and Bruce Pike. The creation of the MIL within CIM underscores our commitment and visibility in the biomedical sector and further complements the outstanding work of another CIM member Prof. Kaleem Siddiqi.

- **CIM PhD CANDIDATE WINS PRESTIGIOUS BEST PAPER AWARD IN MEDICAL IMAGING**

Peter Savadjiev, PhD candidate with Prof. Kaleem Siddiqi, was awarded one of five "best student paper awards" at MICCAI 2005, the *Eighth International Conference on Medical Image Computing and Computer Assisted Intervention*, in the category Simulation and Visualization. MICCAI is the premier international conference on medical image computing and medical robotics.

The award was given for his paper entitled "3D Curve Inference for Diffusion MRI Regularization", co-authored with Jennifer Campbell, Bruce Pike, and Kaleem Siddiqi. This is only the second time a Canadian has won this award in the history of the conference.

In 2005, MICCAI received 632 paper submissions from 36 countries on five continents. Each paper was reviewed by four different reviewers on a double-blind basis, and a rank was assigned to each paper based on the reviews.

A total of 236 papers were accepted as contributions, out which the 46 top-ranked papers were selected for oral presentation, and the others for poster presentation. Student awards were given based on the rank of the paper, the quality of the presentation at the conference and the originality of the contribution.

In addition to a monetary award of $US 1000, Peter Savadjiev was one of 14 authors invited to submit a full-length article to a special edition of the *Medical Image Analysis Journal*, a leading scientific venue for the publishing of high quality original papers related to the applications of computer vision and robotics to biomedical imaging problems. Peter's article has been published in the October 2006 issue of the journal.

- **FQRNT- INRIA COLLABORATIVE PROJECT**

CIM member Prof. Kaleem Siddiqi and collaborators Dr. Bruce Pike of the Montreal Neurological Institute and Dr. Rachid Deriche of INRIA Sophia Antipolis submitted a renewal for funding under the FQRNT – INRIA partnership program. Their goal is to continue to develop and validate algorithms for Diffusion Magnetic Resonance Imaging (MRI) to better understand the organization of the brain. Through an FFCR (Fonds France-Canada pour la Recherche) of 2003 – 2005, both research teams had the chance to meet once in France and once in Canada where enriching scientific discussion occurred and directions for collaborations were identified. Since February 2005, Prof. Siddiqi's former Master's student Maxime Descoteaux has been pursuing his PhD degree at INRIA, under the direction of Dr. Deriche.

During 2005 -2006, Maxime spent the month of January at CIM, working on validating the Odysée analytical ODF technique on the McGill biological data. In April 2006, Drs. Langlet and Deriche spent four days at CIM and the McConnell Brain Imaging Centre giving research presentations on their ongoing work, and further developing research directions to take.

This initiative was the first-ever approved under the FQRNT – INRIA RS partnership program and Prof. Siddiqi hopes to continue these exchanges with renewed funding for the next cycle.

- **WELCOME TO A NEW ASSOCIATE MEMBER**

The Centre's membership formally approved the addition of a new associate member in December 2005. Dr. Iliav A. Bonev is an assistant professor in mechanical engineering at Ēcole Technologie Supérieure (ĒTS) in Montréal. He is currently collaborating with CIM member Prof. Paul Zsombor-Murray of the Department of Mechanical Engineering and co-publishing with Prof. Clément Gosselin of the QERRAnet - RĒPARTI group at Un. Laval. His research interests in industrial robotics and automation will provide a value-added feature to our Centre, in that he will be co-supervising students and sharing equipment and much-needed lab space in ĒTS.

- **CIM IN THE MEDIA - AQUA ON DISCOVERY CHANNEL'S *DAILY PLANET***

The AQUA underwater robot project remains a strong attraction at CIM. Some aspects of the project were originally funded by IRIS/PRECARN and the core research related to underwater vision and robotics is currently funding by an NSERC Strategic grant. The project examines sensor fusion, control and behavior in an amphibious vehicle.

Journalists from the *Daily Planet*, a premiere Canadian science television program, visited our Centre during the summer of 2006. They interviewed various faculty and students for an upcoming show on robotics research. The footage is due to air in September 2006 and the *Daily Planet* producers expressed interest in a subsequent visit to see more of our work.

Funding Sources

FQRNT – QERRAnet PROJECT
2001 - 2005

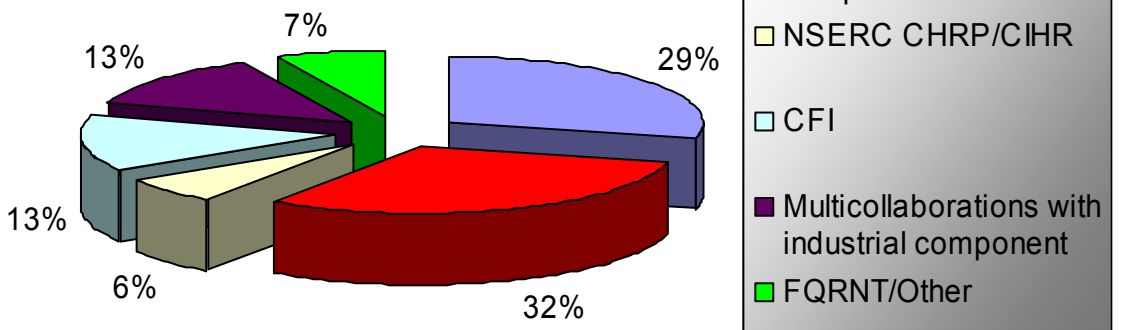
The primary funding source for the Centre for Intelligent Machines in 2005 – 2006 was the Réseau ***Regroupement Stratégique*** program of the Québec NATEQ-FQRNT division. Our project, called QERRAnet, was in its final year during 2005 -2006. It is comprised of 12 members from the Centre for Intelligent Machines and 9 members from Université Laval. The QERRAnet project contributed direct financial support as follows:

FQRNT	$ 115,000
McGill Matching	$ 90,000
Members contributions	$ 40,000
Total Direct Revenue	$ 245,000

The McGill Matching Fund budget of $90,000 is used exclusively to cover the costs of *both salaries and benefits* for the following staff: M. Gray, Manager: J. Binder, Systems Manager; and C. Davidson, CIM administrative support. These staff members provide direct support to the CIM's large and complex infrastructure. Our staff hold permanent and classified positions as recognized by McGill's Department of Human Resources. However, the financial support for these salaries and benefits are not covered by the University's central administration. In addition, these costs are ineligible for funding under any other research funding program. Therefore we view the FQRNT – Regroupement Stratégique program and McGill's matching fund component as critical to the success of our operations.

Organizationally, the Centre for Intelligent Machines and the Regroupement stratégique projects QERRAnet and RĒPARTI are highly synergetic in nature. Each enterprise is headed by a different Director and is subjected to different reporting requirements and financial management. This creation of an an organization within a primary organization offers both challenges and opportunities to our staff. While we embrace new research initiatives, in reality the administrative demands on our limited staff numbers are daunting. We look to our university to both recognise this reality and take the necessary steps to provide research intensive organizations such as ours equitable financial support.

CIM Members and Associates
Annual Funding



Source	Amount ($)
NSERC and NCE	947 000
NSERC with industrial component	1 029 000
NSERC CHRP/CIHR	210 000
CFI	446 000
Multi-collaborations with industrial component	445 000
FQRNT/Other	228 000
Total Annual Funding ($)	3305 000

INDIRECT SOURCES of FUNDING

The National Centres of Excellence Program represented by IRIS, the Institute for Robotics and Intelligent Systems, reached a milestone in its 15 year history of providing valuable support to the Canadian robotics industry. As of March 31, 2005 this program came to completion. Our members lead discussions with PRECARN, the industry-intensive arm of the IRIS program, to find viable alternatives to funding inter-university programs.

CIM members have strengthened their linkages with industry, as evidenced by the increase in projects with industrial sponsors this year. In 2005 – 2006, five CIM members were either PI's or contributing members of six Strategic Projects totalling almost $500,000 annually; three members held NSERC RPP's, CRD's and TGAPS at a value of approximately $250,000 annually; and four members are involved in multi-collaborative initiatives with industry amounting to over $400,000 per annum.

Also noteworthy is the fact that our members have benefited extensively from the CFI program. Since the program's inception, seven CIM members have participated in CFI awards amounting to $1.5M.

In 2005-2006, the CFI program contributed over $400,000 in annual funding. This included a CRC Chair and CRC CFI Infrastructure grant.

Membership and Scientific Output

- **MEMBERSHIP AND STUDENTS**

For the period June 1, 2005 to May 31, 2006, the membership of CIM totaled 18 full members, 1 emeritus member and 6 associate members. There were 103 graduate students housed at CIM who are registered in their respective departments. The Centre also contributes substantially to the training of undergraduate students – this year, 8 honours undergrads studied in the labs of CIM.

Dept.	Full Members	Associate Members	PhD Students	Masters Students	Visiting Researchers	Visiting Professors	Foreign Students
ECE	9	1	39.5	28.5	2		1
ME	6	2	9	9	2	2	2
SOCS	3	3	7	10	2		1
Total	**18**	**6**	**55.5**	**47.5**	**6**	**2**	**4**

* .5 denotes co-supervised

- **SCIENTIFIC OUTPUT**

Internationally, CIM's presence in the community of researchers in areas related to intelligent systems is prominent. The publication output for 2005-06 for CIM members is indicated below:

	Full	Assoc.	Total
Refereed Articles/Journals	48	11	59
Refereed Conference Proceedings	74	60	134
Books	2	0	02
Chapters	5	01	06
Total	**129**	**72**	**201**

For a complete list of publications per member, please see the Annual Report submissions of the respective departments –

- ***Department of Electrical and Computer Engineering***
- ***Department of Mechanical Engineering***
- ***School of Computer Science***

Financial Planning

- **SUCCESSFUL COMPLETION OF THE RĒSEAU QERRANET RESEARCH PROGRAM UNDER REGROUPEMENT STRATĒGIQUE OF FQRNT**

❖ **PROJECT QERRAnet WRAP-UP**

As previously stated, CIM's primary source of funding over the past four years has been the **Réseau Regroupement stratégique programme** of the Québec government's FQRNT.

The primary objective of the **QERRAnet** project -- **Réseau Québécois de recherche en réalité artificielle distribuée --** was to create a network comprised of Quebec's leading scientists in the areas of artificial intelligence, computer vision and robotics (collectively known as intelligent systems) for the purpose of developing a new research program in virtualized and shared reality (VSR).

The mission statement of QERRAnet is:

To investigate the use of distributed information systems to create shared environments across different physical locations.

The Réseau QERRAnet was comprised of the following members from McGill and Un. Laval:

Prof. Jorge Angeles
Prof. Tal Arbel
Prof. Benoit Boulet
Prof. Peter Caines
Prof. Jeremy Cooperstock
Prof. James Clark
Prof. Gregory Dudek
Prof. Frank Ferrie, Director
Prof. Vincent Hayward
Prof. Michael Langer
Prof. Kaleem Siddiqi
Prof. Robert Bergevin
Prof. Clément Gosselin
Prof. Patrick Hébert
Prof. Denis Laurendeau, Assoc. Director
Prof. Xavier Maldague
Prof. Marc Parizeau
Prof. Denis Poussart
Prof. André Zaccarin

A key milestone of the **Réseau QERRAnet** was the design and implementation of the QERRAnet Shared Presentation Facility (QSPF), a virtual seminar room enabling participants from Laval and McGill to "come together" at a distance.

The virtual room was created by linking wall-sized displays and camera systems that permitted participants in each lab node to view their counterparts, remote presenters and audio-visual data in realtime.

We are proud to announce that we exceeded our management and scientific objectives. The following represents various seminars that were jointly held between Un. Laval and CIM/McGill in 2005 – 2006 utilizing our Ultra-Videoconferencing Facility:

Regis Poulin- Laval/CVSL
I*nterface homme-machine permettant le déplacement dans un environnement virtuel par l'action d'une marche libre.*

"Man-machine interface allowing the user of a virtual environment to simulate the action of walking in a virtual world while sensing the topography of this virtual world"

Vénérée Randrianarisoa - Laval/CVSL
Détection d'objets multi-parties par regroupement perceptuel de type descendant
"Detection of Multi-part Objects by Top-down Perceptual Grouping"

Catherine Laporte - McGill/CIM
Efficient viewpoint selection for active object recognition
"Sélection efficace de points de vue en reconnaissance active d'objets"

Joseph Luc - UBC/McGill/CIM
Towards "meaning"ful haptics: An overview of research at UBC's SPIN Lab
"Vers la communication par l'haptique: un aperçu de la recherche au laboratoire SPIN de l'UBC"

Philippe Lambert - Laval/CVSL
Les Light Fields, ou pourquoi décrire la trajectoire des photons
"Light Fields: why we wish to describe the trajectory of photons"

Sébastien Lafontaine - Laval/CVSL
Ajout d'un module d'évaluation de la qualité vidéo à un encodeur MPEG
"Addition of a video quality evaluation module to an MPEG encoder"

- **CONTINUED SUCCESS IN THE NATEQ-FQRNT REGROUPEMENT STRATEGIQUE PROGRAMME**

❖ CENTRE RĒPARTI – START-UP

The membership undertook a strategic review of CIM's financial viability and reevaluated our funding direction.

With considerable attention to planning, detail and discipline, a subset of our CIM members joined forces with Université Laval to create the ***Centre RĒPARTI, a Strategic Team for the Study of Distributed Intelligent Environments.***

Centred within the Department of Electrical Engineering of Université Laval, and under the leadership of Prof. Denis Laurendeau, a proposal for a new centre named ***Regroupement stratégique pour l'Étude des Environnements PARTagés Intelligents répartis (RÉPARTI)*** was submitted to NATEQ in the fall of 2005.

We are proud to announce that **RĒPARTI** was granted funding for a period of 6 years, commencing 2006 to 2012, at $300,000 per annum.

The **RĖPARTI** initiative consists of a multidisciplinary, inter-institional team comprised of 24 members across 5 universities in Québec -- Un. Laval, McGill, Un. Sherbrooke, Ēcole Polytechnique and Université de Montréal. There are 11 CIM members in this group.

This team's depth and talent is renowned nationally and internationally for their significant contributions to the areas of computer vision and intelligent environments. The newly formed centre will 1) conduct advanced research on intelligent environments, 2) improve the quality of life of individuals in reducing the effects of their geographic distribution, 3) train highly qualified personnel, 4) create opportunities for technology transfer and economic development and 5) lead to a greater influence within the province of Québec in this key technological sector.

The research program of **RÉPARTI** is composed of three sub-themes:

1) perception
2) modelling – assessment – learning
3) interaction

This project will provide a core funding base for CIM over the next 6 years, and will increase our collaborative initiatives significantly. Part of our research will be expanded to address the scientific and technical questions of how to create the illusion that all participants share a common space – with significant impact on important applications such as tele-medicine, distance education, and distribution of cultural content to remote regions.

Summary

The research at CIM involves a considerable number of students and staff, and an important outcome of the Centre is the training of highly qualified personnel. Another positive outcome of our Centre is the creation of intellectual property and spin-off companies. Well-integrated into the academic activities of two faculties – Engineering and Science – CIM has an established national and international reputation that consistently attracts new faculty and staff. The breadth of CIM's research makes it possible to offer a rich variety of graduate courses. Since its formation, the Centre has maintained a high level of academic excellence and members are internationally recognized leaders in their respective fields.

A key to longevity in the fiercely competitive world of research funding is to remain adaptable and responsive to the dynamic changes taking place in the research landscape. The evolution of our **Regroupement Stratégique Réseau QERRAnet** into **Regroupement Stratégique Centre RÉPARTI** is tangible evidence of our Centre's open and competitive nature. We select our associate members, and our collaborators, with a clear objective – to strengthen our existing enterprise and still encourage innovative, relevant and curiosity-driven ideas. It is our intent to delve into the far reaches of science and technology for many years to come.

APPENDICES

TO

FOLLOW

APPENDICES

FACULTY MEMBERS

Name	Email @cim.mcgill.ca	Phone (514) 398-	Department
Angeles, Jorge	angeles	6315	Mechanical Engineering
Arbel, Tal	arbel	8204	Electrical and Computer Engineering
Bélanger, Pierre			Electrical and Computer Engineering
Boulet, Benoit	boulet	1478	Electrical and Computer Engineering
Caines, Peter	peterc	7129	Electrical and Computer Engineering
Clark, James	clark	2654	Electrical and Computer Engineering
Cooperstock, Jeremy	jer	5992	Electrical and Computer Engineering
Cortelezzi, Luca	crtlz	6299	Mechanical Engineering
Dudek, Gregory	dudek	4325	School of Computer Science
Ferrie, Frank	ferrie	6042	Electrical and Computer Engineering
Hayward, Vincent	hayward	5006	Electrical and Computer Engineering
Langer, Michael	langer	3740	School of Computer Science
Levine, Martin	levine	7115	Electrical and Computer Engineering
Michalska, Hannah	michalsk	3053	Electrical and Computer Engineering
Misra, Arun	misra	6288	Mechanical Engineering
Nahon, Meyer	mnahon	2383	Mechanical Engineering
Sharf, Inna	isharf	1711	Mechanical Engineering
Siddiqi, Kaleem	siddiqi	3371	School of Computer Science
Zsombor-Murray, Paul	paul	6311	Mechanical Engineering

ASSOCIATE MEMBERS

Name	Email	Phone (514) 398-	Department
Kovecses, Jozsef	jozsef.kovecses@mcgill.ca	6302	Mechanical Engineering
Mannor, Shie	shie@ece.mcgill.ca	1467	Electrical and Computer Engineering
Mongrain, Rosaire	rosaire.mongrain@mcgill.ca	1576	Mechanical Engineering
Panangaden, Prakash	prakash@cs.mcgill.ca	7074	School of Computer Science
Pineau, Joelle	jpineau@cs.mcgill.ca	5432	School of Computer Science
Precup, Doina	dprecup@cs.mcgill.ca	6443	School of Computer Science

CIM MEMBERSHIP:
HONOURS, AWARDS AND RECOGNITIONS
2005 - 2006

Name	Award	Organisation
Jorge Angeles	Fellow "*For contributions to the kinematics, dynamics and design of robotic mechanical systems*."	IEEE Robotics & Automation Society
Tal Arbel	Faculty Award	NSERC
	Salary Award	McGill University
Peter Caines	Fellow	Royal Society of Canada
	James McGill Professor	McGill University
	Macdonald Professor	Dept. Electrical and Computer Engineering
James Clark	Associate Dean, Academic	Faculty of Engineering
	Associate Chair (acting)	Dept. of Electrical and Computer Engineering – Aug, 31, 2005
Jeremy Cooperstock	"Most Innovative Use of New Technology" for *McGill Ultra-Videoconferencing System*	ACM/IEEE *Gateway to Discovery, Supercomputing Conference 2005*, Seattle, WA, USA. November, 2005
Gregory Dudek	Dawson Scholar	McGill University
Vincent Hayward	Invited Speaker Invited Lecture Best Paper Award: *A Role for Haptics in Mobile Interaction : Initial Design Using a Hand-held Tactile Display Prototype,* J. Luk, J. Pasquero, S. Little, K MacLean, V. Lévesque and **V. Hayward** Best Paper Award: Qi Wang and **Vincent Hayward:** *Compact, Portable, Modular, High-performance, Distributed Tactile Transducer Device Based on Lateral Skin Deformation*	2nd Enactive Workshop, McGill University, Montreal, CANADA Journées Bilan ROBEA 2006, CNRS, Paris, FRANCE, March 2006 CHI 2006, Montreal, CANADA, May 2006 Haptic Interfaces for Virtual Environment and Teleoperator Systems, Washington DC, USA, March 2006
Meyer Nahon	Associate Fellow Listed Nominated for Outstanding Teaching Award	American Institute of Aeronautics and Astronautics American Men & Women of Science 23rd Edition Faculty of Engineering- McGill University
Paul Zsombor-Murray	Visiting Research Scientist	University of Leoben, AUSTRIA, - Institute for Automation
Kaleem Siddiqi	Nominated for NSERC Steacie Fellowship	McGill University
	Nominated for Carrie M. Derrick Award for Graduate Teaching Supervision	McGill University
	Dawson Scholar	McGill University
	Co-authored: Best Student Paper Award: *3D Curve Inference for Diffusion MRI Regularization*, Peter Savadjiev, Jennifer S.W. Campbell, G. Bruce Pike, **Kaleem Siddiqi**	Medical Image and Computer Assisted Intervention Conference Palm Springs, CA, USA. Oct. 26- 30, 2005.

CIM STUDENTS:
HONOURS, AWARDS AND RECOGNITIONS
2005 – 2006

Year	Name	Award	Organisation
June 2005	Jonathan Duquette	Dean's Honour List – M.Eng.	McGill
2005 – 2006	Harkirat Singh Sahambi	Public Safety and Emergency Preparedness Canada Research Fellowship in honour of Stuart Nesbitt White"	The Association of Universities and Colleges of Canada
2005	Danny Dionne	Dean's Honour List - PhD	McGill
2005	Zhongjing Ma	Dean's Honour List – M.Eng	McGill
2005	Bhavin Jayprakash Shastri	Honours Distinction - B.Eng	McGill
2005	Michael Thomas Tolley	Honours Distinction and Dean's Honour List – B.Eng	McGill
2005	Julien Marcil	Great Distinction British Association Medal Dean's Honour List – B.Eng	McGill
2005	Carmen Au and Sandra Skaff	Bronze Poster "*Anomaly Detection for Video Surveillance Applications*	IS 2005- 15th Annual Canadian Conference on Intelligent Systems, Québec, CANADA June 5 – 7, 2005
2005	Matthew Leslie Alan Garden	Dean's Honour List – M.Sc. Scholarship	McGill Precarn
2004 – 2006	Alessio Salerno	Werner Grauper International Fellowship	McGill
2004-2005	Qi Wang	J.W. McConnell Major Fellowship	McGill
June 2005	Andrew Phan	VP–Research USRA Award	McGill
	Gurman Singh Gill	Tomlinson Award	McGill
Sept. 2005	Seyed Ali Modarres Najafabadi	Graduate Student Fellowship Major Award	McGill McGill
Sept. 2005	Samuel Audet	Research Scholarship	NSERC
Jan 2005 – Jan 2006	Yves Boussemart	Invited Student Researcher: Software Engineering Research Laboratory	Massachusetts Institute of Technology
March 2005	Evgeni Kiriy	Industry – NSERC Scholarship Scholarship	Lockheed Martin Canada Inc. FQRNT
Sept. 2005	Donovan Parks	NSERC CGS Scholarship Paul and Helen Trussell Science and Technology Scholarship	NSERC British Colombia Innovation Council

	Frank Rudzicz	Graduate Scholarship	FQRNT
		Patent pending:	
		Canada Graduate Scholarship (PhD)	NSERC
2006		Paper published: **Rudzicz, F**. *Put a Grammar Here: Bi-Directional Parsing In Multimodal Interaction*	CHI2006-EA Conference on Human Factors in Computing Systems, Montreal, CANADA April 24-27, 2006
2005-2006		Canadian GS – D3 Award	NSERC
May 2004 – Dec 2005	Chao Chen	Graduate Student Fellowship – D3 Scholarship	FQRNT
2005	Philip Kwizera Mbonye	Internal Scholarship	VRQ
Jan 2005	David McConkey	USRA	NSERC
2004-2005	Phillip Sawbridge	PGSA Scholarship	NSERC
June 2005	Mohammed Shahid Shaikh	D.W. Ambridge Prize - for post doctoral work in the Physical Sciences	McGill
Oct. 2005	Peter Savadjiev	Best Student Paper Award: *3D Curve Inference for Diffusion MRI Regularization*, **Peter Savadjiev**, Jennifer S.W. Campbell, G. Bruce Pike, Kaleem Siddiqi	Medical Image and Computer Assisted Intervention Conference Palm Springs, CA, USA. Oct. 26- 30, 2005.
Nov. 2005	Luz Abril Torres-Mendez	3rd best poster: *A Statistical Learning-Based Method for Colour Correction of Underwater Images* **Luz Abril Torres-Méndez** and Gregory Dudek	The Fourth Mexican International Conference on Artificial Intelligence, Monterrey MEXICO, November 14-18, 2005
2005	Daniel Burfoot	Graduate Faculty Fellowship	McGill
		Monbusho Research Student Scholarship	Japanese government
2005	Hsin Yun Yao	NSERC IPS Scholarship,	Immersion Canada
Feb 2006	Jérôme Pasquero	Best Paper Award: Luk, J., **Pasquero, J**.,Little,S., MacLean,K., Lévesque,V., Hayward., *A Role for Haptics in Mobile Interaction : Initial Design Using a Handheld Tactile Display Prototype*	Proc. of CHI 2006,Montreal, Canada Aril 24- 27, 2006
Feb 2006	Vincent Lévesque	Best Paper Award: Luk, J., Pasquero, J.,Little,S., MacLean, K. **Lévesque,V**., Hayward,V., *A Role for Haptics in Mobile Interaction : Initial Design Using a Handheld Tactile Display Prototype*	Proc. of CHI 2006,Montreal, Canada April 24- 27, 2006
May 2005	Isabelle Bégin	Best Poster Award: Bégin, I. and Ferrie, F.P., *Multi-Scale Technique and Quality Assessment for Blind Super-Resolution*	Seventh **Geo**matics for Informed **De**cisions meeting – Québec, QC Canada, *May 2005*

Sept. 2005	Leonard Phong Vu	ECE Entrance Scholarship	McGill University
		ECE Excellence Award	McGill University
2005	Zhi Qi	Scholarship	Precarn
2005	Philippe Giguère	PGS Fellowship	NSERC
March 2006	Qi Wang	Best Paper: **Qi Wang** and Vincent Hayward, *Compact, Portable, Modular, High-performance, Distributed Tactile Transducer Device Based on Lateral Skin Deformation*	14th Symposium on Haptic Interfaces For Virtual Environment and Teleoperator Systems, IEEE VR 2006. Washington, DC, USA March 25 – 26, 2006
October 2005	Matthew Toews	Paper presented: **Matthew Toews**, D. Louis Collins and Tal Arbel: *Maximum A Posteriori Local Histogram Estimation for Image Registration*	MICCAI 2005 - 8th International Conference on Medical Image Computing and Computer Assisted Intervention, Palm Springs, CA, USA, Oct 26 - Oct 30, 2005
2005-2006	Katia Bilodeau	Canadian Graduate Scholarship	NSERC
2005-2006	Carmen Au	Scholarship	Precarn
2005-2006	Sandra Skaff	Scholarship	Precarn
2005-2006	Junaed Sattar	Scholarship	Precarn

SEMINARS

CONTROL, NETWORKS, GAMES SEMINAR SERIES

A Contract-Based Model for Directed Network Formation
Prof. Shie Mannor, Dept. ECE, McGill University, *June 23, 2005*

Market Mechanisms for Network Resource Allocation: A Characterization Theorem
Prof. Ramesh Johari, Dept. ECE, Stanford University, *July 25, 2005*

Hamilton-Jacobi-Isaac Formulation for Constrained Input Systems: Neural Network Solution
Prof. Frank L. Lewis, Murad Abu-Khalaf, PhD Candidate, Dept. of Electrical Engineering, University of Texas at Arlington, Dr. Jie Huang, Dept. of Automation and Computer-Aided Engineering, The Chinese University of Hong Kong, *August 1, 2005*

Tutorial/Literature Review: F. P. Kelly, "Loss Networks", The Annals of Applied Probability Vol. 1, No. 3. (Aug., 1991), pp. 319-378
Zhongjing Ma, Ph.D candidate, Dept ECE., McGill University, *September, 30, 2005*

Tutorial/Literature Review: Murat Alanyani, "Learning Automata in Games with Memory with Application to Circuit-Switched Routing" 43rd IEEE Conference on Decision and Control, December 14-17, 2004 Atlantis, Paradise Island, Bahamas
Prof. Lorne Mason, Dept. ECE, McGill University, *October 28,2005* and *November 11, 2005*

Learning Nash Equilibria in Uncoupled Games
Prof. Gabor Lugosi Department of Economics, Pompeu Fabra University, Barcelona, SPAIN, *November 18, 2005*

Asymptotics of Efficiency Loss in Competitive Market Mechanisms
Jia Yuan Yu, Ph.D Student, Dept. ECE, McGill University, *November 25, 2005*

Multi-Modal Control: Complexity, Expressiveness, and Optimal Control
Magnus Egerstedt, School of Electrical and Computer Engineering, Georgia Institute of Technology, Georgia, USA, *February 17th, 2006*

Tracking with Sleepy Sensors (joint work with J. Fuemmeler)
Prof. Venugopal V. Veeravalli, Dept. ECE, University of Illinois at Urbana-Champaign, USA. *March 20, 2006*

Worst-Case and Probabilistic Models of Uncertainty: Benefits and Pitfalls
Roberto Tempo, Director of Research and Systems and Computer Engineering, IEIIT-CNR, Politecnico di Torino, ITALY, *April 3, 2006*

Routing from PSTN to MPLS
Gerald Ash, AT&T Labs, Middletown, NJ USA, April 07, 2006

Wardrop, Nash, Stackelberg and Co.
Patrice Marcotte, Computer Science and Operations Research, Université de Montréal, CANADA, *April 07, 2006*

Regret minimization under partial monitor
Gilles Stoltz, Chargé de recherche CNRS, Ecole Normale Supèrieure, Paris FRANCE, *April 28, 2006*

HUMAN-MACHINE INTERACTION

Sensory Perception and Interaction Research
Karon MacLean, SPIN,Dept. of Computer Science, UBC, CANADA, *June 08, 2005*

Inferring External Stimulus Properties from Internal Sensory States Alone Through Action and Invariance
Dr. Yoonsuck Choe, Asst. Prof., Dept. of Computer Science, Texas A&M University, *August 3, 2005*

Networking with a Difference
Dennis N. Cooper, ICT Centre Networking Technologies Laboratory, CSIRO, Marsfield, NSW, Australia, *May 18, 2006*

Robotics
Bio-Inspired Climbing Robots
Dr. William Provancher, Dept. of Mechanical Engineering, University of Utah, *July 20, 2005*

Approaches to Cooperative Manipulation with Mobile Robots
Dr. Wes Huang, Dept. of Computer Science, Rensselaer Polytechnic Institute, *September,29,2005*

ROBOTIC MECHANICAL SYSTEMS

Robots that Search and Rescue, Crawl and Climb, and Perform Surgery in the Operating Room:

"Putting Theory into Practice
Dr. Alon Wolf, Institute for Computer Assisted Orthopaedic Surgery - The Western Pennsylvania Hospital, and The Robotics Institute, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA *October 7, 200.5*

The 100g Capturing Robot: Too Fast to See!
Prof. Makoto Kaneko, Industrial Engineering, Hiroshima University, JAPAN, *October 19, 2005*

Virtual Surgery and the Freedom 6S
Dr**.** Marilyn Powers, Ms. Claudette Linton and Dr. Ian Sinclair, MPB Technologies Inc. Montreal, Quebec, CANADA *March 3rd 2006*

Velocity Degeneracies of 7-Jointed Revolute Manipulators
Prof. Ron Podhorodeski, Dept. of Mechanical Engineering, University of Victoria, B.C. CANADA, *March 8, 2006*

DynaFlexPro: Modelling Multibody Mechatronic Systems using Linear Graph Theory
Dr. Chad Schmitke, MotionPro Inc. Waterloo Ontario, CANADA, *March 10th 2006*

Dynamics and Optimal Control of Motions for Robots and for Human Rehabilitation
Prof. James Bobrow, Dept. of Mechanical and Aerospace Engineering, University of California, Irvine, CA, USA, *March 24th 2006*

Demonstrations of Real-Time Control and Mechatronics Experiments
Erlisa Jorganxhi and Andrew Romhanyi, Quanser Inc. Markham Ontario Canada, *April 20th 2006*

Legged Robots at Boston Dynamics
Martin Buehler (former member of CIM), Boston Dynamics, Boston, MA, USA, *October 7th 2005*

SCHOOL OF COMPUTER SCIENCE

Automatically Generating High-Quality User Interfaces for Appliances
Jeffrey Nichols, Human-Computer Interaction Institute School of Computer Science Carnegie Mellon University, USA, *February 26th 2006*

Beyond the Traditional Image: Depicting Reality by Merging Multiple Photographs and Videos
Aseem Agarwala, Department of Computer Science and Engineering, University of Washington, USA *March 3rd, 2006*

Computer Vision for Panoramic Viewing and Augmented Reality
Mark Fiala, The Computational Video Group, National Research Council of Canada, *April 5th 2006*.

Laboratories at CIM

Aerospace Mechatronics Laboratory (AeML)
Directors: Inna Sharf and Meyer Nahon
The Aerospace Mechatronics Laboratory, co-directed by Profs. Inna Sharf and Meyer Nahon, houses research activities in the areas of dynamics and control of aerospace mechatronic systems. These include space robots, tethered aerostats and unmanned aerial vehicles.

The equipment in the laboratory includes a 6-axis CRS robot mounted on a 3 m translational track, a number of helium balloons and blimps, and vision, force and motion measurement systems, including wireless data acquisition systems. Force measurement is accomplished using load cells (6-asix and single-axis), while motion measurement is performed using a stereo camera, high-accuracy differential GPS, or conventional lower-accuracy GPS; accelerometers, rate gyros, and ultrasonic position sensing. The laboratory is supplemented by additional facilities for the testing of aerostats at McGill's MacDonald campus on the West Island of Montreal.

Researchers in this laboratory are working on topics such as aerostat and airship dynamics and control, control algorithms for autonomous capture of stranded satellites, rovers and flight vehicles for Mars exploration, modeling of contact dynamics, offshore oil platform dynamics and control, underwater vehicle dynamics and control, and parameter estimation for these systems.

Appearance Modelling Laboratory (AML)
Director: Michael Langer
The Appearance Modeling Laboratory carries out basic research in computer vision, computer graphics, and human visual psychophysics. It is the only lab in Canada that addresses vision problems from all of these perspectives. The equipment in the lab is provided by CFI and includes several high end workstations and measurement devices such as digital cameras, a spectral radiometer, and a photometer for carrying out calibrating imaging.

Artificial Perception Laboratory (APL)
Director: Frank Ferrie
This lab is one of 3 in Canada (excluding facilities at the NRC) equipped to perform 3-D imaging using a number of different modalities (laser triangulation using plane of light and auto-synchronized scanning, LIDAR, stereography, depth from defocus, and sonar). The laboratory also includes several precision manipulator systems (CRS 3000 series gantry robot system, PUMA 500 & 260 manipulators, and numerous linear and rotational positioning stages), as well as an extensive software library for data acquisition, robot control, and interpretation of 2-D and 3-D images.

Computation Visualization and Realization Laboratory (CVRL)
Director: Kaleem Siddiqi
Made possible by a CFI award, the CVRL includes facilities for high performance computation (a Beowulf cluster with 32 CPU's), rapid prototyping (Stratasys FDM 3000 rapid prototyping machine), and scientific visualization (SGI workstations and software). It is our only accessible facility for rapid prototyping in the Montréal area, and a tremendous boon to our research program.

Content-Based Image Retrieval (CBIR)
Director: Martin Levine
The CBIR facility is the repository of an extensive set of software tools for non-textual database indexing and image retrieval. Developed over the years at McGill, the CBIR facility ranks among the top tier of research worldwide and has led to the development of several commercial successes.

Haptics Laboratory (HL)
Director: Vincent Hayward
World renowned for both fundamental scientific contributions as well as applied research, the Haptics laboratory is only one of 3 in Canada. It is equipped to cover a broad spectrum of research, ranging from the development of novel displays to systems involving haptic interaction (e.g. force feedback). The laboratory includes facilities for the fabrication and testing of haptic devices (machining, electronics, and measurement systems), specialized computational resources (real-time systems, high performance numerical simulation) and psychophysical testing (specialized manipulators and force measuring systems).

Industrial Automation Laboratory (IAL) and Systems and Control Laboratory
Director: Benoit Boulet
The result of another CFI award, the IAL was designed to provide an experimental platform for investigating systems and control theory in a context relevant to modern industrial control. It includes a Feedback Systems Model 38-100 Basic Process Rig and a Model 38-600 Temperature Process Rig, which are capable of emulating the kinds of processes typical of real-world environments. Together with the related computational facilities, the IAL is one of only 3 comparable facilities in Canada.

Medical Image Laboratory (MIL)
Director: Tal Arbel
Created with the assistance of a CFI award, the MIL focuses on applications of research in computer vision to problems in medical imaging, with particular emphasis on building tools for image-guided neurosurgery and spine surgery. The laboratory includes cutting edge equipment found in modern operating rooms worldwide including a portable ultrasound machine, a POLARIS tracking system, and high-end workstations.

Mobile Robotics Laboratory (MRL)
Director: Gregory Dudek
This laboratory addresses high-level aspects of autonomous systems research such as environmental modeling, task planning, cooperative execution involving multiple robots, and distributed intelligence. The largest facility of its kind in Canada, and one of the top 10 in North America, its equipment includes six mobile robots (one Nomadic Technologies Nomad 200, 3 Nomad Superscouts, 1 RWI B-12, and a Cyberworks prototype maintenance robot), analog and digital telemetry systems, optical and sonar sensing systems (LIDAR, optical triangulation, sonar arrays, etc.), plus an extensive library of software developed over a period of 10 years.

Motor Vision Laboratory (MVL)
Director: James Clark
The MVL is another laboratory created as a result of a CFI award, with emphasis on the understanding of visual attention. As such the laboratory is equipped with facilities for tracking the state of human observers as they perform visual tasks. Equipment includes an ISCAN eye tracking system, numerous video capture systems, calibrated displays for psychophysical experiments, and robotic systems for positioning various imagers.

Robotic Mechanical Systems Laboratory (RMSL)
Director: Jorge Angeles
The RMSL provides experimental support for research in manipulator design and control, ranging from computational support in the form of computer aided design and simulation to the physical realization of novel manipulator systems. In addition to the manipulators designed by laboratory scientists (DIESTRO, RE-DIESTRO), facilities include generic robot control systems, test facilities for servomechanisms, measurement systems such as end-point trackers, force transducers, and various data acquisition systems for performance measurement. The RMSL ranks among the top robotics research facilities in Canada.

Shared Reality Laboratory and Environment (SRL) (SRE)
Director: Jeremy Cooperstock
The SRL is another facility made possible by a CFI grant, and is perhaps the most unique facility of its kind in Canada (and one of a handful in the world). Its novelty lies in the concept of interconnected room-sized immersive displays, modeled on the University of Chicago CAVE, but 3-sided, for the purpose of creating virtual shared environments across different physical locations. Two display rooms have been completed with others under construction. In addition to the display hardware, facilities include various kinds of imagers and sensors, high speed networking facilities, video streaming facilities, as well as a Silicon Graphics Onyx II computer system equipped with dual processors.

CIM VISITORS

June 1, 2005 – May 31, 2006

Name (Type)	From	Period	Supervisor/Contact
Guillaume Hirigoyen (Visiting Researcher)	8 rue de Rouen 92400 COURBEVOIE, FRANCE	2005.01.18 - 2005.08.31	ANGELES
Lucas Chabert (Foreign Student)	Ecole Centrale Nantes 1, rue de la Noe BP 92 101 44 321 NANTES Cedex 3 FRANCE	2005.04.11 – 2005.08.15	ANGELES
Céline Drapeau (Stagiaire)	Concordia University 1455 Maisonneuve Boulevard West Montréal QC H3G 1M8	2005.07.03 – 2005.08.30	FERRIE
Hamid Tagihrad (Visiting Professor)	K.N. Toosi University of Techonolgy Dept. of Electrical Engineering P.O. Box 16315-1355 Tehran IRAN	2005.07.18 – 2006.06.30	NAHON
Martin Tändl (Visiting Researcher)	Chair for Mechanics University Duisburg-Essen Lotharstrasse !, Duisburg, GERMANY	2005.08.29-2005.12.31	ANGELES
Sylvain Bouix (Visitor)	Brigham and Women's Hospital 1249 Boylston Street Boston MA 02214 USA	2005.09.05 – 2005.09.09	SIDDIQI
Allan Tannenbaum (Visitor)	School of Electrical and Computer Engineering Georgia Institute of Technology 777 Atlantic Drive NW Atlanta, GA 30332-0250 USA	2005.09.08 – 2005.09.10	SIDDIQI
Richard Neumayr (Visiting Researcher)	Magna Powertrain Lebenauver Street 314 805 1 Graz, AUSTRIA	2005.09.27 - 2005.10.12	ZSOMBOR-MURRAY
Tim Kietzmann (Foreign Student)	Universität Osnabrück 49074 Osnabrück GERMANY	2005.11.01 – 2005.12.31	DUDEK
Prof. Mircea Munteanu (Visiting Professor)	Transylvania University Eroilor, 29 22 Brasou ROMANIA	2005.11.22-2002.11.29	ANGELES
David Roodenburg (Foreign Student)	Technical University of Delft Mekelweg 2, Delft, THE NETHERLANDS	2006.02.07-2006.04.30	BOULET
Frank Bauer (Foreign Student)	Fachhochschule Münster University of Applied Sciences Stegerwaldstrasse 39 48565 Steinfurt GERMANY	2006.03.28 -2006.09.22	ANGELES
Yosuke Kinoe (Visiting Researcher)	2-17-1 Fujimi, Chiyoda-ku TOKYO 102-8160	2006.04.01-2006.09.01	COOPERSTOCK
Faycal Lawayeb (Foreign Student)	Ecole Polytechnique X2003 8ième Lie 91128 Palaiseau	2006.04.11-2006.10.07	ANGELES
Emilie Bouyer (Foreign Student)	Ecole Centrale de Nantes 1, rue de la Noë 44300 Nantes FRANCE	2006.04.17-2006.09.01	ANGELES

STUDENT RESEARCH TOPICS INFORMATION

Student	Program	Supervisor and Co-supervisor	Topic/Thesis
Ahmedali, Trevor	M.Eng	Clark	Reconfigurable Computing for Video Processing
Ajersch, Mark	M.Eng	Boulet	Modelling and Real-Time Control of Sheet Reheat Phase in Thermoforming
Anwar, Zeeshan	M.Eng	Ferrie	Towards Accurate Statistical Space Carving for 3D model Reconstruction
Au, Carmen E.	M.Eng	Clark	Anomaly Detection in Video Surveillance Systems
Ayoub, Omar	M.Eng	Hayward	Model of Equilibrium System
Bhattacharyya, Jisnu	M.Eng	Levine	Detecting and Removing Specularities and Shadows in Images
Boussemart, Yves	M.Eng	Cooperstock	Gesture-Based Scene Editing and Control 3
Boyer, Alexandre	M.Eng	Boulet	Control Designs for the Canadian Large Adaptive Radiotelescope
Castonguay, Danny	M.Eng	Mannor/Caines	Systems
Chan, Siu Chi	M.Eng	Cooperstock	Hand Tracking for Augmented Environment
Coulombe-Pontbriand, Philippe	M.Eng	Nahon	Design of a Test Facility for Tethered Aerostats
Deschênes, François	M.Eng	Nahon	Design Improvements to a Multi-Tethered Aerostat System
Dostmohamed, Hanifa	M.Eng	Hayward	Haptic Shape from Contact Location Trajectory
Duquette, Jonathan	M.Eng	Cortelezzi/Nigam	Nucleation and Growth of Single-Wall Carbon Nanotubes
Epstein, Neil	M.Eng	Cortelezzi	Characterization of Mixing Generated by Coherent Vortical Structures
Garroway, Diana	M.Eng	Hayward	A Haptic Interface for Editing Skypace Curves with Applications to Animation Authoring
Georgiades, Christina	M.Eng	Nahon/Buehler	Simulation and Control of an Underwater Hexapod Robot
Gravel, Jean-Philippe	M.Eng	Levine	Three-Dimensional Face Recognition
Hadjimichael, Basil	M.Eng	Boulet	Manufacturing Execution Systems Integration and Intelligence
Hage, Rita-Helena	M.Eng	Michalska	Control of a Bicycle on a Bumpy Road
Harmouche, Rola	M.Eng	Arbel	Automatic Lesion Segmentation in Magnetic Resonance Images
Hilario, Maria Nadia	M.Eng	Cooperstock	Occlusion Detection for Front Projection Displays

Houde, Geneviève	M.Eng	Angeles	The Calibration of Redundant Serial Robots
Howard, Alistair	M.Eng	Nahon	Design of a Pitch-Controlled Aerostat
Jin, Ming	M.Eng	Zsombor-Murray	Arc-Length Based Parametric Cubic for Real-Time Gaming
Jolicoeur, Marie-Pierre	M.Eng	Boulet	Robust Feedback for Cabin Noise Reduction
Kadoury, Samuel	M.Eng	Levine	Face Detection in Images
Lalli, Dominic	M.Eng	Boulet	Advanced Control of Forming Processes
Lalli, Gino	M.Eng	Boulet	In-Cycle Control of Extrusion Blow Moulding Process
Law, Albert	M.Eng	Ferrie	Object Tracking in Sequential Videos
Liu, Guoxin	M.Eng	Angeles	The Feasibility of a Six-Axis Isotropic Serial Robot for Training in Programming and Control (project)
Malik, Imran Haider,	M.Eng	Angeles	The Dynamics and Control of a Schönflies-Motion Generator (project)
Mbonye, Kwizera Philip	M.Eng	Ferrie	Motion Estimation of Road Traffic from Uncalibrated Mounted Cameras (project)
McConkey, David Eric	M.Eng	Caines	Optimality Zones in Optimal Hybrid Systems Control Algorithms
Meunier, Gabriel	M.Eng	Boulet	Control of the Canadian Large Adaptive Radiotelescope
Miller, Jonathan Israel	M.Eng	Nahon	Design of Advanced Aerostats
Modarres Najafabadi, Seyed Ali	M.Eng	Angeles	Robot Dynamics and Control in Contact Task
Nair, Vinod	M.Eng	Clark	Distributed Video
Nava-Hernandez, Sergio	M.Eng	Angeles	The Optimum Design of Epicyclic Trains of Spherical Cam-Roller Pairs
Neville, Neil	M.Eng	Sharf/Buehler	Dynamic Bipedal Running of a Highly-Underactuated Hexapod Robot
Nie, Jun	M.Eng	Zsombor-Murray	Planar Dyads, Four-Bar and Image Space Insight Upon the Design Problem
Parks, Donovan	M.Eng	Levine	Object Recognition
Patel, Prakash	M.Eng	Ferrie	Towards Direct Motion and Shape Parameter Recovery from Image Sequences
Perez, Michael	M.Eng	Cooperstock	Redesigning the Automated Door Attendant
Qin, Zhongkai	M.Eng	Angeles	Design and Analysis of a Two-DOF Novel Drive Unit for Parallel Robots
Qu, Wei	M.Eng	Caines	Demonstration of Non-linear Oscillatory Behavior in Auction-based Internet Pricing Control
Rajwade, Ajit	M.Eng	Levine	Facial Pose Estimation, Feature Extraction and Recognition From 3D Shape Information

Riggi, Frank	M.Eng	Arbel	Incorporating Invariant Features in Fundamental Matrix Estimation
Rioux, François	M.Eng	Cooperstock	Semantics and Interpretation of Gesture in the Context of Immersive Environments
Rudzicz, Frank	M.Eng	Cooperstock	Understanding Language: Understanding in Multimodal Interaction
Sato, Akihiro	M.Eng	Buehler	A Planar Hopping Robot with One Actuator: Design...
Sawbridge, Phillip	M.Eng	Michalska	Estimation/Target Tracking
Sud, Daniel	M.Eng	Cooperstock	Design of a Multi-Projector Display System
Tilton, Nils	M.Eng	Cortelezzi	Linear Stability Analysis of Poiseuille Flows with Porous Walls
Vanreusel, Stephen	M.Eng	Michalska	Active Noise Control Systems
Wei, Wei	M.Eng	Zsombor-Murray	Type Synthesis and Kinematic Analysis of Translational Parallel Manipulators
Wozniewski, Michael	M.Eng	Cooperstock	Gesture Acquisition and Toolglass Interface Design
Yu, Alexander	M.Eng	Zsombor-Murray	Parallel Robots with 'Three Points on Three Lines' Architecture
Yu, Yingfeng	M.Eng	Levine	Face Recognition
Zhu, Yibin	M.Eng	Angeles	The Optimum Design of a Parallel Schönflies-Motion Generator (project)
Ahuja, Sumedha	M.Sc	Dudek	Keyphrase Extraction and Information Retrieval
Burfoot, Daniel	M.Sc	Dudek	Range-based Recognition and Pose Estimation
DiMarco, Paul	M.Sc	Dudek	Vision-based Localization in Underwater Environments
Farasat, Yousef	M.Sc	Langer	Motion Parallax and Specularities on Smooth Undulating Surfaces
Marinakis, Dimitri	M.Sc	Dudek	Topology Inference in Distributed Sensor Networks
Sattar, Junaed	M.Sc	Dudek	Underwater Visual Servoing for AQUA (an Underwater Robot)
Yu, Jia Yuan	M.Sc	Mannor	Network Resource Allocation Games
Descoteaux, Maxime	MSc	Siddiqi	Multi-Scale Geometric Flow for Segmenting Vasculature in MRI: Theory and Quantitative Validation
Eckbo, Ryan	MSc	Siddiqi	Computer Vision
Stolpner, Svetlana	MSc	Siddiqi/Whitesides	Computer Vision and Computational Geometry
Zhang, Juan	MSc	Siddiqi	3D Object Recognition Using Medial Surface and their Graph Spectra
Bhatia, Aditya	MSc.	Langer	Rendering Snow

Ghandi, Maulin	MSc.	Levine	A Method for Automatic Synthesis of Aged Human Facial Images
Pereira, Javeen Carl	MSc.	Langer	Spectral Snow
Rekhi, Dipinder Singh	MSc.	Langer	Motion Turbulence Visualization
Al-Widyan, Khalid	Ph.D	Angeles	The Robust Design of Robotic Mechanical Systems
Arseneau, Shawn	Ph.D	Cooperstock	Multiple Target Tracking by Spatiotemporal Volumes
Bégin, Isabelle	Ph.D	Ferrie	Blind Super-Resolution Using a Learning-Based Approach
Boily, David	Ph.D	Michalska	Recurrent Neural Networks in Application to Pursuit-Evasion Dynamical Games and Classification Theory
Bourque, Eric Howard	Ph.D	Dudek	Procedural Texture Matching and Transformation
Brooks, Rupert	Ph.D	Arbel	Active Vision for Ultrasound Slice Selection in Image-Guided Surgery
Cadotte, Patrick	Ph.D	Boulet	Optimal and Robust l1 Control
Cadotte, Patrick	Ph.D	Michalska	Robust L-Infinity Stability of Systems with Repeated Perturbations
Campbell, Jennifer	Ph.D	Siddiqi/Pike	Diffusion Imaging of White Matter Fibre Tracts
Campion, Gianni	Ph.D	Hayward	Computer Graphics for Surgical Simulation
Cardou, Philippe	Ph.D	Angeles	Rigid-Body Pose and Twist Estimation from Point-Acceleration Measurements
Cayouette, François	Ph.D	Cooperstock	Generic Object Tracking in a Semi-Dynamic Scene
Chao, Chen	Ph.D	Angeles	Optimization of Epicyclic Transmissions of Planar Cam-Roller Pairs
Dionne, Dany	Ph.D	Michalska	Integrated Detection, Estimation and Guidance in Pursuit of a Moving Target
Duan, YingXuan	Ph.D	Boulet	Robust Tunable Control
Ehtiati, Tina	Ph.D	Clark	Attention Models for View-based Object Recognition
Fan, Shufei	Ph.D	Ferrie	Passive 3-D Model Acquisition via Hybrid Modelling
Ganine, Vladislav	Ph.D	Michalska	Distributed sensing, Detection and Estimation
Garden, Matthew	Ph.D	Dudek	Learning-Based Recommender Systems
Gauthier, Guy	Ph.D	Boulet	Iterative Learning Control
Giguère, Philippe	Ph.D	Dudek	Mobile Robotics
Gill, Gurman Singh	Ph.D	Levine	3D Morphable Models for Face Recognition

Gosline, Andrew Havens	Ph.D	Hayward	High-Fidelity Deformable Models for Surgical Simulation
Hadzagic, Melita	Ph.D	Michalska	Particle Filters in Tracking of Rapidly Manoeuvring Targets
Hernandez-Alonso, Diana	Ph.D	Clark	Modelling the Spatial Structure of Image Surrounds
Jie, LI	Ph.D	Clark	Attention-Tracking Model
Khan, Waseem Ahmad	Ph.D	Angeles	Conceptual Design of Robots
Kiriy, Evgeni	Ph.D	Michalska	Adaptive Filtering for Multisensor Data Fusion
Lala, Prasun	Ph.D	Ferrie	Characterizing Motion Scale Space in Video Using Psychophysical Correlates
Lambert, Casey Marcel	Ph.D	Nahon	Dynamics and Control of a Multi-Tethered Aerostat System
Laporte, Catherine	Ph.D	Arbel	Active Object and Pose Recognition
Lévesque, Vincent	Ph.D	Hayward	Virtual Braille Display
Li, Muhua	Ph.D	Clark	Learning Invariant Neuronal Representations for Objects Across Visual-related Self-actions
Li, Yuwen	Ph.D	Nahon	Airship Dynamics and Control
Lu, Mu-Chiao	Ph.D	Michalska	Time Delay Systems in Receding Horizon Control
Luo, Lianzhen	Ph.D	Nahon	Contact Dynamics for Space Robotics Simulation
McCloskey, Scott	Ph.D	Siddiqi/Langer	Depth from Defocus
Mitran, Marcel	Ph.D	Ferrie	Analysis of Image Statistics
Nasrallah, Danielle	Ph.D	Angeles/ Michalska	Dynamics and Control of an Anti-tilting Two-Wheeled Mobile Robot on Uneven Terrain
Pasquero, Jérôme	Ph.D	Hayward	Virtual Braille Display
Pelletier, Stéphane	PhD	Cooperstock	High-Resolution Video Synthesis
Ranganathan Iyer, Shivakumar	Ph.D	Nahon	Mechanics and Control of Thrown Tethers
Sahambi, Harkirat Singh	Ph.D	Levine	Object Recognition and Retrieval
Salerno, Alessio	Ph.D	Angeles	Design, Dynamics and Control of a Fast Quasiholonomic Robot for Human Augmentation
Savadjiev, Peter	Ph.D	Siddiqi	Medical Imaging
Selman, Abdulrazzak	Ph.D	Michalska/ Hayward	Model Predictive Tracking Control for Constrained Systems with Time Delays
Shaikh, Shahid Mohammed	Ph.D	Caines	Optimal Control of Hybrid Systems: Theory and Algorithms

Simhon, Saul	Ph.D	Dudek	A Machine Learning Framework for the Classification and Refinement of Hand Drawn Curves
Skaff, Sandra	Ph.D	Clark	Statistical Models of Color Perception
Smith, James Andrew	Ph.D	Sharf/Buehler	Analysis and Implementation of Quadruped Four-Beat Gaits
Sun, Wei (Victoria)	Ph.D	Cooperstock	Parallel Distributed Camera Arrays for Intelligent Multi-camera Target Tracking
Toews, Matthew	Ph.D	Arbel	Information Theoretic Image Registration
Torres-Mendez, Luz Abril	Ph.D	Dudek	Sensor Fusion for a 3D Environment Modelling
Verma, Siddharth	Ph.D	Sharf/Dudek	Vision-Based Motion Parameter Estimation
Wang, Qi	Ph.D	Hayward	Towards a Tele-Touch System
Yao, Hsin-Yun	Ph.D	Hayward	Touch Magnifying Instrument Applied to Minimum Invasive Surgery
Yin, Jianfeng	Ph.D	Cooperstock	Video Interpolation and Synthesis for View Reconstruction
Zhi, Qi	Ph.D	Cooperstock	Efficient Stereo Matching and View Reconstruction
Zhongjing, Ma	Ph.D	Caines	Distributed Control of Jump Process in Market-Based Communication Networks via State Aggregation