PROGRESS REPORT 2011-2012

Department of Geomatics Engineering

Schulich School of Engineering
University of Calgary

Position Yourself Ahead of the Crowd

G

GEOMATICS
ENGINEERING

SCHULICH
School of Engineering

UNIVERSITY OF CALGARY

UCGE Number 50043

PROGRESS REPORT
2011/2012

DEPARTMENT OF
GEOMATICS ENGINEERING
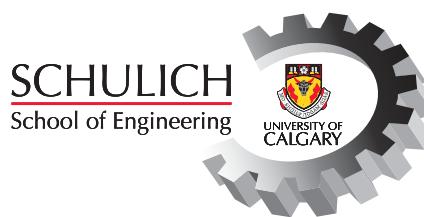
May 2012

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Admitted to the Degree of
BACHELOR OF SCIENCE

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Omar Faisal Hazaa Al-Emrani (Internship)
Ovidiu Andrei
Hartej Singh Bal (Internship)
Marc Joseph Campagne (Distinction)
(Internship)
James C.H. Chan (Internship)

Usman Yusuf Cokar
Erin Colborne (Internship)
Alfred Benedict D'Mello (Internship)
Paul Arthur Deering (Distinction)
Kevin Patrick Doherty
Derek Eamer
Ryan Scott Enns (Internship)
Duncan Ernst
Janna Nicole Fung (Distinction) (Internship)
Jean-Sebastien Gauthier-Mathieu (Internship)
Alexander Matthew Hanna (Internship)
Bryan Hoang (Internship Program)
Mark Richard Horneman
Carey Michael Lavoie
Allen Gretzky Philip Lee

Bryan James Leedham (Internship)
Andrew William Ma
Collin Vincent Marquardt
Alexander Ngu
Jennifer Dawn Nordlund
Stephan Robert Normandeau (Internship)
James Wooldridge O'Neill
Junyoung Park (Internship)
Mitchell Kane Scheuerman
Hitomi Shiratate
Pamela Jane Starratt (Internship)
David James Ernest Townsend
Brett K. Vaile
Dominika Wcislo (Internship)
Natasha Wong Ken

Admitted to the Degree of
MASTER OF SCIENCE

Musa Shammi Akther
Behnam Aminian
Ting On Chan
Scott Fraser
Oday Haddad
Elmas Sinem Ince
Mohammed Hatef Keshvadi

Andrés Ortíz
Kazi Mahmudur Rahman
Rohana Rezel
Navdeep Sekhon
Thaer Shunnar
Siddharth Siddharth
Mohamed Tamazin

Admitted to the Degree of
DOCTOR OF PHILOSOPHY

Pratibha B. Anantharamu
Muhammad Haris Afzal
Hassan Elsaid Elhifnawy Eid
Ahmed Kamel

Ana Paula Baungarten Kersting
Yasser Maghsoudi Mehrani
Shashank Satyanarayana
Wesley J.E. Teskey

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HIGHLIGHTS 2011/2012

2011/2012 has been a very good year in the Department's development and its aspiration to maintain its national and international leadership in the Geomatics filed. Before listing the main highlights of this period, I would like to start by thanking all the faculty and support and technical staff for their services, contributions, and continued commitment to the Department. Also, I would like to thank our undergraduate and graduate students for their achievements and dedication. This year, we had 58 students finishing their undergraduate and graduate degrees (36 BSc, 14 MSc, and 8 PhD). On behalf of the department, I would like to congratulate our graduates and wish them all the best in whatever endeavor they undertake and hope that they will promote the department wherever they are. We will rely on these graduates as our ambassadors to the Geomatics professional society and the whole community in general. We will make every effort possible to keep in touch with them as this is very important for keeping us abreast of any challenges they might have as well as providing feedback regarding their educational experience in the Department.

♦ 58 students graduated from Geomatics Engineering at U of C.

♦ 'Lunch with Google' was held on November 16, 2011 to promote geomatics to first year engineering students and an information night was held on February 27, 2012.

♦ The Geomatics program is accredited by the Canadian Engineering Accreditation Board for the next six years.

In an effort to promote Geomatics Engineering to First Year Engineering Students, we had a Lunch with Google event on November 16th (the event was sponsored by Tecterra). Ed Parsons, Google's Geospatial Technologist, made an excellent presentation that was attended by more than 150 participants including close to 80 First Year Engineering Students. In addition, we had another event on Monday, February 27, 2012. This event was sponsored by the Alberta Land Surveyors' Association (ALSA) and Department of Geomatics Engineering. ALSA and Trimble provided information about career opportunities in Geomatics. Combined with these events, we had focus group meetings with first year engineering students to determine what students know about geomatics engineering. We also conducted a national poll to identify the public's perception of Geomatics. As a result, we developed a set of posters that highlight the availability and versatility of the Geomatics employment in different fields. These events and activities had a positive impact on this year's placement of first year Engineering Students. More details about these events are provided in a later section of this progress report.

The Department is pleased to share with you that our faculty members and students received several prestigious national and international awards. In this years' Capstone Design Fair, which took place on April 11th, Geomatics students won the first, second, and third place for the best three projects among almost 100 projects (Internet of Things & Quadcopter; Subdivision Design: Nosehill; and Terrestrial Photogrammertry) as voted by the student body. Our faculty members and students have received several awards such as the Schulich School of Engineering Mentoring Excellence Award; UofC Students' Union Teaching Excellence Award; ASTech Award

for Outstanding Leadership in Alberta Technology; American Society of Photogrammetry and Remote Sensing (ASPRS) Photogrammetric (Fairchild) Award; and President's Citation Certificate from the International Society of Photogrammetry and remote Sensing (ISPRS).

On another front, the Canadian Engineering Accreditation Board's (CEAB) made a visit to the Schulich School of Engineering on 27-29 November 2011. This visit typically occurs every six years. The purpose of the accreditation is to identify engineering programs whose graduates are academically qualified to begin the process to be licensed as professional engineers in Canada. The process of accreditation emphasizes the quality of the students, the academic and support staff, and the educational facilities. I am pleased to report that the CEAB has extended accreditation of the Geomatics undergraduate engineering programs for the maximum period of six years, until June 2018. The CEAB's decision was based on a thorough review by the Visit Team and the Accreditation Board and it speaks volumes about the high quality of our program, faculty, staff, and students.
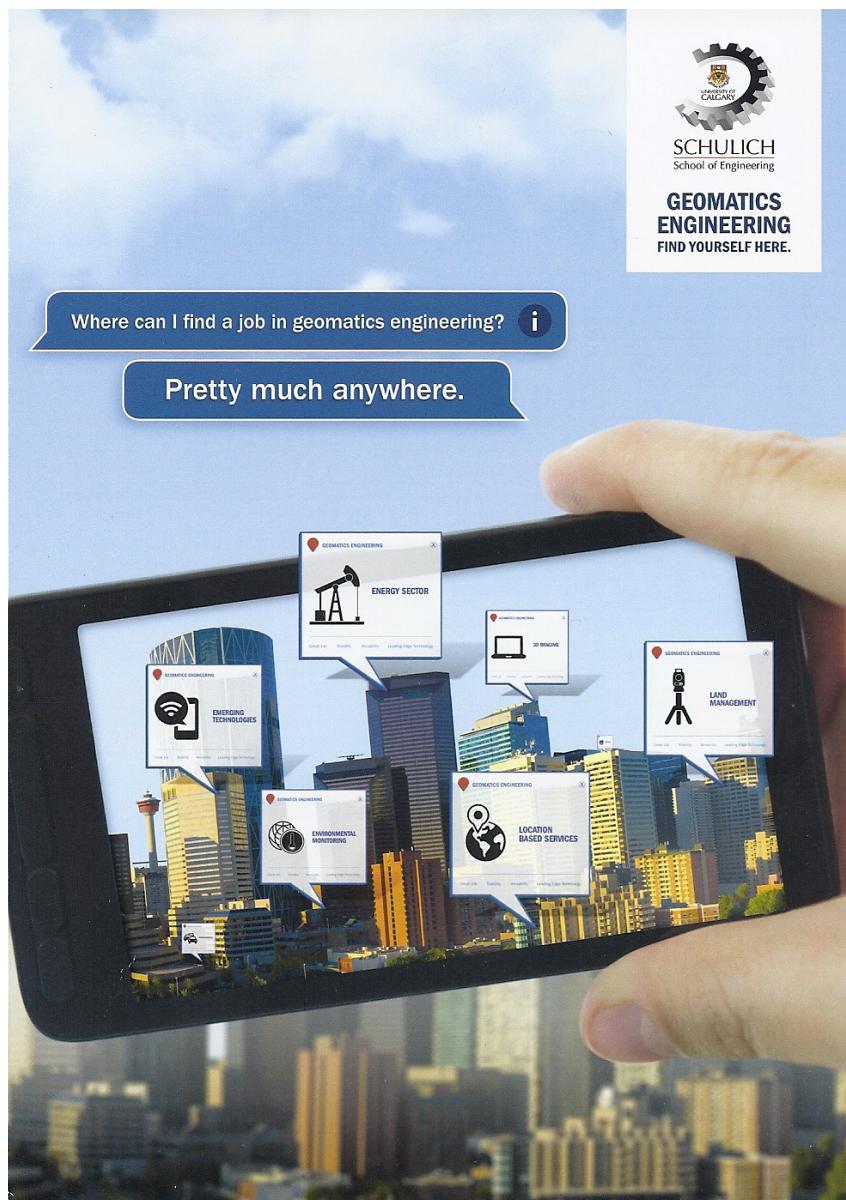
Finally, I am pleased to announce the appointment of Dr. Ruisheng Wang as an Assistant Professor in the Department. Dr. Wang, who holds a PhD in Electrical and Computer Engineering from McGill University, will commence his duties on August 1, 2012. His most recent work has been in research and development with NOKIA Corporation in Chicago, Il., USA. He will be a valuable addition to the whole Department, in general, and the Digital Imaging Systems stream, in particular.

Dr. Ayman F. Habib, PEng.
Professor and Head

Geomatics Engineering
Faculty Members and Staff at the Annual Retreat
June, 2011

Standing LtoR: D. Lichti, M. Barbaro, M. Rempel, K. Collins, D. Marceau, S. Skone, A. Hunter, J. Lai, B. Teskey, X. Wang, M. Sideris, Y. Gao, Q. Hassan
Sitting: LtoR: M. Petovello, K. O'Keefe, A. Habib, G. Lachapelle, N. El-Sheimy.

MESSAGE FROM THE DEAN

As I round out the end of my first year here at the Schulich School of Engineering, I continue to be impressed with the caliber of teaching and research that takes place in the Geomatics department of this school.

As you will see in the proceeding pages, our researchers continue to conduct leading edge research in a field that is becoming an essential part of our modern lifestyle. Our students are also benefitting from the expertise and teaching skill that our faculty is able to share with them.

In the coming year, we will be looking for new ways to attract more students to this field. I look forward to working with you to continue to build the profile of geomatics in the engineering capital of Canada.

Guy Gendron, PEng, PhD
Dean, Schulich School of Engineering

AWARDS AND RECOGNITION

Dr. Michael Sideris, who completed his 2007-2011 term as President of the International Association of Geodesy (IAG), is the new Vice President of the International Union of Geodesy and Geophysics (IUGG) for the period 2011-2015. Dr. Sideris was elected to this position by the 69-country-member Council of IUGG at the XXV IUGG General Assembly.

A team of researchers from the University of Calgary won the 2011 Royal Institute of Navigation (RIN) Michael Richey Medal for the best research paper published in the Royal Institute of Navigation Journal of Navigation. The award-winning research was conducted by UofC PhD candidate **Glenn MacGougan** in 2006-2009 under the co-supervision of Drs. Kyle O'Keefe, and Richard Klukas. The paper "Tightly-coupled GPS/UWB Integration", was published in Volume 63, issue 1 of the Journal of Navigation in January 2010.
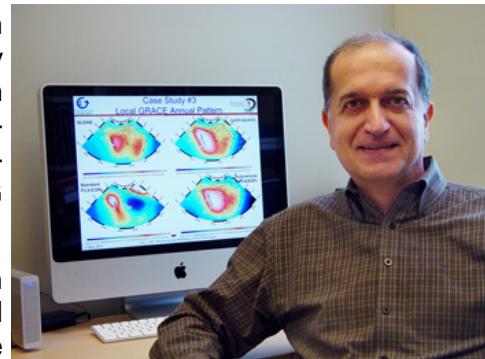
Michael Sideris has been elected vice president of the International Union of Geodesy and Geophysics (IUGG). Photo by Jennifer Sowa

Mr. Jing Wang and **Dr. Xin Wang**, members of Intelligent Geospatial Data Mining Laboratory, received second prize in the 2011 GeoAlberta Conference Map Gallery contest (Best Student Category), for their work "A Traffic Accident Risk Mapping System".

Forty-two teaching assistants recently received a Schulich School of Engineering Teaching Assistant Award. From Geomatics Engineering, congratulations to the following: for Teaching Assistant Excellence Awards **Ana Kersting**, ENGO 531; **Jacky Chow**, ENGO 343. For Teaching Assistant Effectiveness Awards, **Andrew Phillips**, ENGO 551; **Billy Chan**, ENGO 421 & ENGO 465; **Feng Xu**, ENGO 361; **Navdeep Sekhon**, ENGO 559 & ENGO 583; **Herve Lahamy**, ENGG 233; **Fatemeh Ghafoori**, ENGG 233; **Feng Tang**, ENGG 233; **Baijie Wang**, ENGG 233.

University of Calgary president **Elizabeth Cannon** was one of nine foreign associates inducted into the 2011 class of the National Academy of Engineering (NAE). Election to the NAE is among the highest international professional distinctions accorded to an engineer. Dr. Cannon's contributions to the field of geomatics spans a 25-year research career and her initiatives undertaken as a professor continue to thrive and shape the direction of the field. She was elected to the United States National Academy of Engineering "for innovative use of GPS data for a wide range of applications and for pioneering the field of geomatics."

Dr. Ayman Habib was this year's recipient of the Teaching Excellence Award for third and fourth year courses in Geomatics Engineering. The award was presented by the University of Calgary Engineering Students Society at their annual Third and Fourth Year Dinner.

The following graduate students won highly competitive Student Sponsorship Awards from the U.S. Institute of Navigation to present their papers at the GNSS 2011 International Conference held in Portland, OR. **Shuang Du,** *An Inertial Aided Cycle Slip Detection and Identification*

AWARDS AND RECOGNITION, continued

Method for Integrated PPP GPS/MEMS IMU Systems. Nima **Sadrieh,** *Spatial Antenna Diversity Performance for Indoor GNSS Applications,* and **Xing Zhao,** *Multi- Sensors Observability Analysis on Pedestrian Navigation System*.

Dr. Naser El-Sheimy was the 2011 recipient of the prestigious ASTech (Alberta Science and Technology) Award for Outstanding Leadership in Alberta Technology. The ASTech Awards are the premiere acknowledgement of scientific and technological achievement in Alberta. The Outstanding Leadership in Alberta Technology award is presented to an individual or team of individuals who have played a leadership role in, and made a contribution to, a technological innovation or breakthrough in Alberta.

Dr. Mark Petovello was presented with The Geomatics Engineering Teaching Award of Excellence. This is the second time Dr. Petovello has won this award, given in recognition of his consistently excellent teaching of undergraduate, graduate, and professional courses.

Dr. Naser El-Sheimy was this year's recipient of the Geomatics Engineering Graduate Educator Award.

Dr. Kyle O'Keefe won the Geomatics Engineering Research Excellence Award.

The Schulich School of Engineering Mentoring Excellence Award was presented to **Dr. Gérard Lachapelle** in recognition of years of support he has provided to his many colleagues and former students.

Dr. Kyle O'Keefe was named this year's Geomatics Engineering Professor of the Year at the 2012 Schulich School of Engineering Graduation Banquet. Kyle was selected for this honour by the members of the 2012 graduating class.

The following Geomatics graduate students won Awards at the ASPRS Annual Conference. **Ivan Detchev** (Supervised by Professor Dr. Habib) was the 2012 recipient of the Robert E. Altenhofen Memorial Scholarship. **Jacky Chow** (Supervised by Professor Dr. Teskey and Dr. Lichti) was the 2012 recipient of the Z/I Imaging Scholarship. **Ana Kersting** (Supervised by Dr. Habib) was the 2012 recipient of the Francis H. Moffitt Memorial Scholarship.

Dr. Kyle O'Keefe and **Dr. Mark Petovello** each received teaching awards at the Schulich School of Engineering's First and Second Year Dinner. The award winners are selected by students in first and second year engineering.

Professor Cannon received the Centennial Leadership Award from the Association of Professional Engineers and Geoscientists of Alberta at its annual meeting held in Edmonton.

Dr. Mark Petovello received a 2011-2012 Students' Union Teaching Excellence Award for his efforts teaching ENGO 465—Satellite Positioning in Winter 2012. The award was presented at the Students' Union Teaching Excellence Awards Gala.

The following graduate students**, Saeed Daneshmand** and **Ali Jafarnia-Jahromi** placed third out of nearly forty competing teams in the 2012 National Security Innovation Competition organized by the (U.S.) National Homeland Defense.

PERSONNEL

Faculty
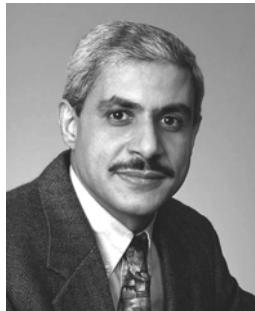
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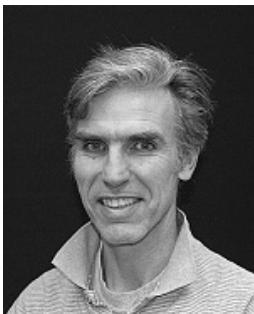
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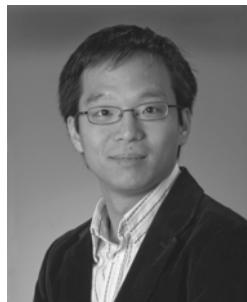
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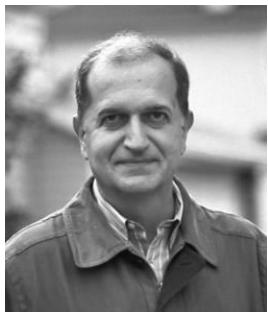
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Professors Emeritus

In Memoriam

KLAUS-PETER SCHWARZ

Dr. Klaus-Peter Schwarz, a world-renown inertial geodesist and Professor emeritus, Geomatics Engineering, University of Calgary, passed away in Calgary at 3:30 am on Friday, January 20, 2012 at age 73.

Dr. J.A.R. Blais, Ph.D. (University of New Brunswick), P.Eng. Estimation, spectral analysis, information theory and systems numerical methods, reference systems and gravitation.

Dr. E.J. Krakiwsky, Ph.D. (Heiskanen Award; The Ohio State University), P.Eng. Least squares estimation and statistical testing, network design, satellite positioning, automatic vehicle location and navigation systems.

Dr. A.C. McEwen, Ph.D. (University of London), C.L.S., N.L.S., Cadastral studies, survey law, land registration systems, international land and maritime boundaries surveys for aboriginal land claims.

Dr. K.P. Schwarz, Dr.-Ing. (Summa cum laude; Technical University of Berlin), P.Eng., Geodesy, inertial techniques, airborne gravimetry, kinematic positioning and attitude determination by GPS/INS, multi-sensor systems, real-time applications.

Adjunct Professors

Dr. Anil Gupta
Alberta Environment

Dr. Don Leckie
Natural Resources Canada

Dr. Bryan Mercer
Intermap Technologies Corp.

Dr. Aboelmagd Noureldin
Royal Military College of Canada

Support Staff
Administrative

Marcia Rempel, Administrative Manager

Monica Barbaro, Administrative Assistant

Melissa Ostrowski, Graduate Program Administrator

Courtenay Canivet, Undergraduate Administrator

Farewell Julia Lai who retired after 24 years of committed service to the department and university. She will be greatly missed.

LtoR: Lu-Anne Markland, Garth Wanamaker,. Marcia Rempel, Julia Lai, Monica Barbaro, Kirk Collins

Welcome to two new team members who joined our support staff in the Geomatics Department: Courtenay Canivet (left) and Melissa Ostrowski (right). Courtenay is our Undergraduate Administrator, and Melissa our Graduate Administrator.

Support Staff
Technical

Garth Wanamaker, BSc, Technical Manager

Kirk Collins, BSc, Dipl.Surveying & Mapping Technology, Survey Technician

Post Doctoral Fellows/Research Engineers/Associates/Assistants

Walid Abdel-Hamid
Positioning, Navigation and Wireless Location

Hamid Assilzadeh
Positioning, Navigation and Wireless Location

James Badger
GIS and Land Tenure

Mohamed Bakillah
GIS and Land Tenure

Jared Bancroft
Positioning, Navigation and Wireless Location

Yong Bian
GIS and Land Tenure

David Birkigt
GIS and Land Tenure

Ali Broumandan
Positioning, Navigation and Wireless Location

Yongxiang Cai
GIS and Land Tenure

Yu-Chuan Chang
GIS and Land Tenure

Clement Chion
GIS and Land Tenure

James Curran
Positioning, Navigation and Wireless Location

Vahid Dehghanian
Positioning, Navigation and Wireless Location

Vivek Dey
GIS and Land Tenure

Mohamed El Habiby
Earth Observation

Ricky Kao
Earth Observation

Chris Goodall
Positioning, Navigation and Wireless Location

Ala'a Kassab
GIS and Land Tenure

Christopher Kyle
GIS and Land Tenure

Dong Woo Lee
GIS and Land Tenure

Aiden Morrison
Positioning, Navigation and Wireless Location

Sameh Nassar
Positioning, Navigation and Wireless Location

Elena Rangelova
Earth Observation

Valerie Renaudin
Positioning, Navigation and Wireless Location

Christina Semeniuk
GIS and Land Tenure

Stefan Steiniger
GIS and Land Tenure

Zainab Syed
Positioning, Navigation and Wireless Location

Bin Wang
GIS and Land Tenure

Yigiter Yuksel
Positioning, Navigation and Wireless Location

Guest Lecturers

Special Lecture Series

Dr. Leila Hashemi Beni
Research and Development Centre, Agriculture
and Agrifood Canada
*Extending Geomatics Applications in
Environment Management: Simulation of
Dynamic Phenomena*

Dr. Susanne Bleisch
Geographic Information Science,
City University London
About Data and Mountains

Wen-Yuan Ku
Feng-Chia University, Taiwan
Experience for Integrating Sensor with Cloud

Prof. Dr.-Ing. Wolfgang Forstner
Institute for Geodesy and Geoinformation,
University Bonn
*Probabilistic Data Analysis Using Graphical
Models*

Dr. Jan Skaloud
Ecole Polytechnique Federal Lausanne,
Switzerland
*Special Studies in Integrated Sensor
Orientaion*

Dr. Nesreen I. Ziedan
Zagazig University, Egypt
*1. A Particle Filter Approach for Combined L1/
LC Tracking of Direct and Multipath Signals
2. L2CM and L2CL Acquisition and Carrier Fine
Acquisition for Weak Signals
3. Wireless Indoor Navigation Approach for
Robot Movement Control*

Dr. Jianghui Geng
Scripps Institution of Oceanography
University of California, San Diego
*Ambiguity Resolution in Precise Point
Positioning: Methods, Applications and Future*

Visiting Scientists

Professor Hang Guo
Nachang University, China,

Dr. Kwon Yikyun
Korea Institute of Geoscience and
Mineral Resources

Dr. Sun Wei
Liaoning Technical University

ADVISORY COMMITTEES AND STUDENT AWARDS

Geomatics Engineering Advisory Committee (GEAC)

It is the responsibility of the Geomatics Engineering Advisory Committee to ensure that the undergraduate, graduate and research programs meet the needs of the country and are kept up to date with society and the rapidly changing technologies.

The 35th annual advisory committee meeting was held on Thursday, March 15, 2012. The agenda included a review of 2011-2012, a discussion of the challenges facing the Department in terms of student recruitment and opportunities for growth and change for the future.

Geomatics Engineering Advisory Committee 2012	
Name	**Affiliation**
David Parker, Chair	Viterra
Corinna Vester	Natural Resources Canada
Sandra Czuj	Alberta Environment
Victoria Hoyle	Lytro Camera
Irwin Natt	McElhanney Land Surveys Inc
Grant Chevallier	Chevallier Geo-Con Ltd.
John Welter	North West Geomatics
Fraser Smith	Topcon Positioning Systems
Rita Cheng	Itres
Landra Trevis	The Orthoshop
Kevin Magowan	CDL Systems Ltd

Representatives of the U of C — A. Habib, K. O'Keefe, M. Petovello

Geomatics Engineering Advisory Committee
L to R, Guy Gendron (Dean), Corinna Vester, Rita Cheng, Grant Chevallier, Landra Trevis, Kevin Magowan, Victoria Hoyle, Mark Petovello, Tim Crago, David Parker, Irwin Natt, Ayman Habib, Kyle O'Keefe

Geomatics Engineering Liaison Committee (GELC)

The Geomatics Engineering Liaison Committee met on February 1, 2012. The committee was established to develop an effective and permanent relationship between the Land Surveyors' Associations and the University of Calgary. The committee consists of up to two delegates each from the Land Surveying Associations in Alberta, British Columbia, and Saskatchewan and the Association of Canada Lands Surveyors, a representative of the Federal Government, a member at large, as well as the Associates Head and faculty who teach cadastral courses in the Department of Geomatics Engineering at the University of Calgary.

The main theme of this year's meeting matched our departments rebranding efforts: How to market profession and the "future land surveyor" to students, and also to bring more awareness to government about the role of the land surveyor.

Geomatics Engineering Liaison Committee 2012

Name	Affiliation
Arlin Amundrud	Member at Large
Marie Robidoux	Member at Large
Bronwyn D. Denton	Association of British Columbia Land Surveyors
Paul Dixon	Association of Canada Land Surveyors
Victor Hut	Alberta Land Surveyors Association
Connie Petersen	Alberta Land Surveyors Association
Jill Burridge	Saskatchewan Land Surveyors Association
Peter Sullivan	Surveyor General

Representatives of the U of C — K. O'Keefe (Chair), A. Habib, M. Barry, A.J. Hunter

Student Awards Night

Student Awards Night was held on Wednesday, March 14, 2012. Awards night is an opportunity to publicly recognize the many accomplishments of our graduate and undergraduate students. It also provides an occasion for an informal meeting between members of the profession, students, faculty and other university representatives.

The number of awards available for our students continues to rise, thanks to the commitment of the Geomatics community to our program and to our students.

Geomatics Engineering Graduate Student Award Winners 2012

Ann and Ed Scovill and Hyun Ha

Matthew Tait and Dominika Wcislo

Diane Haley and Gregor Cuddeback

Gerard Lachapelle and Bryan Leedham

Ayman Habib and Huaqiu Liu

Tim Crago and Ivy To

Graduate Awards

Recipient	Awards
Jacky Chow　Alec Huang　Erin Kahr　Fang Wang　Erwan Renaudin	Alberta Innovates — Technology Futures (AITF) - iCore Scholarship
Ivan Detchev	Alberta Innovates — Technology Futures (AITF) - Ingenuity Award
Adel Moussa	Chancellor's Challenge Graduate Scholarship
Jin Baek	Dr. Chen Fong Chancellor's Club Doctoral Scholarship
Coral Bliss Taylor	Eratosthenes Award
Elmas Sinem Ince	Helmut Moritz Graduate Scholarship
Jing Wang	Faculty of Graduate Studies Travel Award
Yasser Maghsoudi Mehrani	Faculty of Graduate Studies Doctoral Scholarship
Adel Moussa	Innovation in Mobile Mapping Award
Billy Chan　SeyedNima Sadrieh	Institute of Navigation (ION) Graduate Award
Tao Lin	Institute of Navigation (ION) Alberta Section Graduate Award
Peng Xie	Institute of Navigation (ION) National Graduate Award
SeyedNima Sadrieh	KIS94 Graduate Scholarship
Ivan Detchev	Len Bolger Memorial Scholarship
Coral Bliss Taylor	L.R. (Dick) Walker Newby Award
Sara Saeedi	Mildred Shaw Book Prize
Jacky Chow　Ivan Detchev　Erin Kahr	NSERC Scholarship & Awards
Eunju Kwak	North West Group Scholarship
Tanvir Ahmed　Coral Bliss Taylor Billy Chan　Fatemeh Ghafoori Ana Kersting　Ben Knoechel Andrew Phillips　Navdeep Sekhon Jing Wang　Gayan Wijesekara	Queen Elizabeth II Awards
Anup Dhital	Werner Graupe International Fellowship in Engineering

Undergraduate Awards

Recipient	Awards
Ivy To	A.D. (Denis) Hosford Scholarship
Paul Deering	Alberta Land Surveyors' Association Scholarship
James O'Neill	British Columbia Land Surveyors Foundation Award
Mitchell Scheuerman	British Columbia Land Surveyors Foundation H.R. Goldfinch Memorial Award
Robyn Soroka	Cannon-Lachapelle Family Scholarship
Hyun Ha	David Scovill Memorial Bursary
Xingman Li	E.J. Krakiwsky Bursary
Huaqiu Liu	Focus Geomatics Engineering Bursary
Towfique Ahmed Hyun Ha Bryan Leedham	Geomatics Engineering '25th Anniversary' Bursary
Marc Campagne	Green MacPhee Endowed Scholarship in Geomatics Engineering
Venice Yuen Ching Tang	Institute of Navigation Alberta Chapter Bursary
Hyun Ha	Institute of Navigation (ION) Undergraduate Bursary
Tanmaya Varma	J.H. Holloway Scholarship in Geomatics Engineering
Samuel Rondeel	Jim Van Dam Scholarship
Luxi Li	John Deyholos Memorial Award
Venice Yuen Ching Tang	KIS-97 Undergraduate Scholarship
Kimberly Borgford	L.R. (Dick) Newby Memorial Award
Matthew Herasymiuk	Leica Geosystems Ltd. Scholarship
Paul Deering	McElhanney Scholarship
Samuel Rondeel	Midwest Surveys' Jerry J. Simpson Memorial Scholarship
Venice Yuen Ching Tang	Ray Lowry Memorial Bursary
Hyun Ha	Scott Anderson Memorial Award in Geomatics
Adam Thomas	Stephen P. Williams Memorial Award
Kyle Ken Loung Chau	TECTERRA Future Geomatics Leaders Award
Gregor Cuddeback	Urban & Regional Information Systems Association Scholarship
Dominika Wcislo	Worley Parsons Geomatic Solutions Bursary

UNDERGRADUATE STUDIES

Enrollment
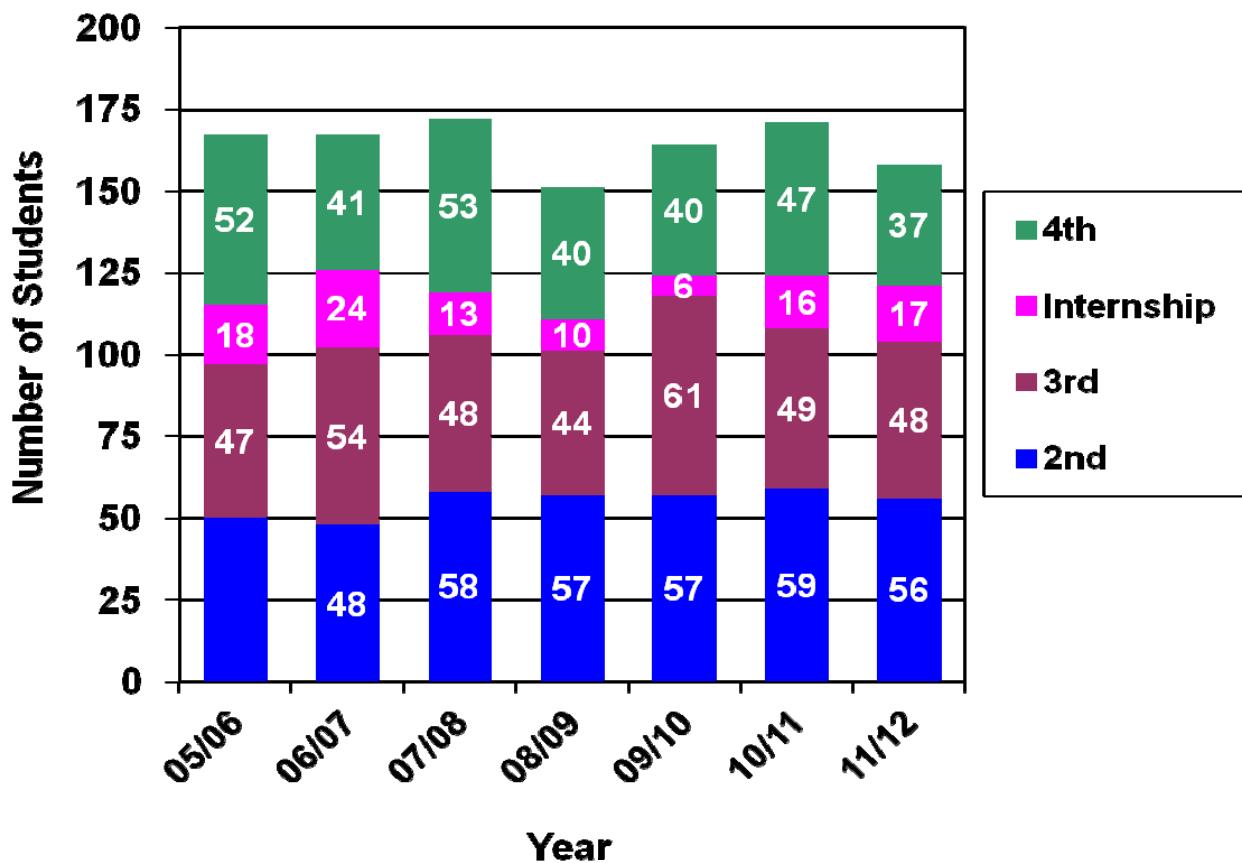
During the 2011/12 academic year, 141 undergraduate students (158 including internship) pursued studies in Geomatics Engineering at the University of Calgary.

Student Enrollment by Geographic Region
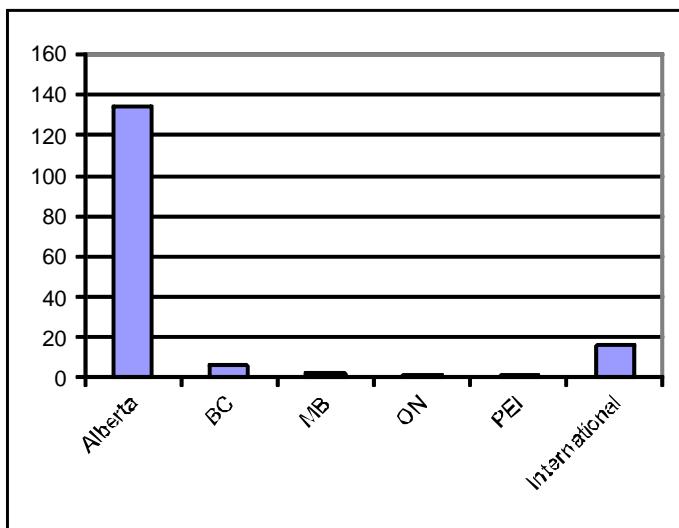
The figure to the left shows a breakdown of student enrollment by geographic region. Students from Alberta remain the largest group, and numbers from the other groups remain fairly constant from year to year.

Undergrad Class Visit Switzerland
May 2011 with Dr. Mark Petovello

COMMON CORE CURRICULUM

The common curriculum for engineering students is shown in the adjacent table.

Students choose their department at the end of the first year and begin studies specific to that department in of second year.

Common Program for All Engineering Students

Year 1	Course Number	Course Name
	AMAT 217	Calculus for Engineers and Scientists
	AMAT 219	Multivariable Calculus for Engineers
	CHEM 209	General Chemistry for Engineers
	ENGG 200	Design and Communication
	ENGG 201	Behaviors of Liquids, Gases and Solids
	ENGG 202	Engineering Statics
	ENGG 225	Fundamentals of Electrical Circuits and Machines
	ENGG 233	Computing for Engineers I
	MATH 211	Linear Methods I
	PHYS 259	Electricity and Magnetism
	COST	Complementary Studies Course
Year 2 (Fall)		
	AMAT 307	Differential Equations for Engineers
	ENGG 319	Probability and Statistics for Engineers
	ENGO 333	Computing for Geomatics Engineers
	ENGG 349	Engineering Mechanics II
	PHYS 369	Acoustics, Optics and Radiation for Engineers
	COST	Complementary Studies Course
Abbreviations		
	AMAT	Dept. of Mathematics & Statistics
	CHEM	Dept. of Chemistry
	COST	Complementary Studies Course
	ENGG	Faculty of Engineering
	ENGO	Dept. of Geomatics Engineering
	PHYS	Dept. of Physics

Undergraduate Curriculum in Geomatics Engineering

Year 2/Winter	Course	
	AMAT 309	Vector Calculus for Engineers
	ENEL 327	Signals and Transforms
	ENGO 343	Fundamentals of Surveying
	ENGO 351	Introduction to GIS
	ENGO 361	Least Squares Estimation
Year 3/Fall	**Course**	
	ENGO 103	Survey Block Week
	ENGG 407	Numerical Methods in Engineering
	ENGO 421	Coordinate Systems
	ENGO 431	Principles of Photogrammetry
One of:	ENGO 443	Geodetic and Engineering Surveys
or	ENGO 451	Design and Implementation of GIS
	COST	Complementary Study
Year 3/Winter	**Course**	
	ENGO 419	Geomatics Networks
	ENGO 423	Geodesy
	ENGO 435	Remote Sensing
	ENGO 455	Land Tenure & Cadastral Systems
	ENGO 465	Satellite Positioning
	COST	Complementary Study
Year 4/Fall	**Course**	
	ENGO 500	Geomatics Engineering Project
	ENGO 501	Field Surveys
	ENGG 513	Role and Responsibilities of the Professional Engineer in Society.
	TE-1	Technical Elective
	TE-2	Technical Elective
	TE-3	Technical Elective
Year 4/Winter	**Course**	
	ENGO 500	Geomatics Engineering Project
	COST	Complementary Study
	COST	Complementary Study
	TE-4	Technical Elective
	TE-5	Technical Elective
	TE-6	Technical Elective

Technical Electives in Geomatics Engineering

Course	
BSEN 395	Business Law for Strategic Decision Makers
BMEN 509	Intro to BMEN Imaging and Applications
BMEN 513	Photogrammetric Techniques
ENEE 555	Energy and Environmental Systems Analysis
ENGO 531	Advanced Photogrammetric and Ranging Techniques
ENGO 545	Hydrography
ENGO 551	Special Topics in GIS
ENGO 559	Digital Imaging and Applications
ENGO 563	Data Analysis in Engineering
ENGO 567	High-Precision Surveys
ENGO 573	Digital Terrain Modelling
ENGO 579	Survey Law and Practice
ENGO 581	Land Use Planning
ENGO 583	Environmental Modelling
ENGO 585	Wireless Location

GEOMATICS ENGINEERING STUDENT SOCIETY

Back (LtoR): VP Academic—Ryan Horton, 3rd Year Rep—Vassu Khurana, 4th Year Rep—Kale Pominville, Webmaster—Carey Lavoie, Frosh/Engg Week Commissioner — Pam Starratt, 2nd Year Rep—Claudia Potok, Switzerland Commissioner—Andrew Salmon, VP External, Photographer—Stephan Normandeau, Middle (LtoR): Athletics Commissioner—Alfred D'Mello, VP Events, Secretary—Alex Lidell, Career Day Commissioner —Tasha Wong Ken & Shana Davis, Front (LtoR): VP Finance—Towfique Ahmed, President—Bryan Leedham, VP Events—Jamie Dainton.

GEOMATICS ENGINEERING SURVEY CAMP AT KANANASKIS

An important part of the undergraduate degree program in Geomatics Engineering is the field camp (ENGO 501). This two week camp is held at the Kananaskis Centre for Environmental Research, prior to the start of the Fall Session. It gives incoming fourth year students the opportunity to apply the knowledge and experience gained in the different areas of geomatics to an integrated practical project.

The Department of Geomatics Engineering would like to thank the following companies for their participation in the annual Survey Camp Equipment Day, or for the generous loan of equipment over the duration of Survey Camp:

Butler Survey Supplies Ltd.
Spatial Technologies

Survey Camp August 2011

ENGINEERING INTERNSHIP PROGRAM

This program offers an optional cooperative educational work experience for all students who have completed their third year of engineering. Participants spend 12 to 16 months in paid jobs, with companies, gaining valuable geomatics experience.

Student Name	Placement Company	Faculty Mentor
Aaron Lai	Husky Energy Inc.	Mike Barry
Adam Hussein	Trimble Navigation	Gerard Lachapelle
Adam Thomas	CDL Systems Ltd.	Yang Gao
Chenlu Qiao	Mentor Engineering Inc.	Naser El-Sheimy
Jasen Stein	Trimble Navigation	Susan Skone
Joel Hergott	Altus Geomatics	Bill Teskey
Jordon Maretzki	Mentor Engineering Inc.	Xin Wang
Luxi Li	Computer Modelling Group Ltd.	Steve Liang
Nathan Turner	Aerotec. LLC	Ayman Habib
Noramin Alizada	McElhanney Land Surveys Ltd.	Michael Sideris
Patrick Skea	Midwest Surveys Inc.	Kyle O'Keefe
Redjie Olino	General Electric Canada	Quazi Hassan
Roger Li	Husky Energy Inc.	Derek Lichti
Ryan Dick	Midwest Surveys Inc.	Mike Barry
Samuel Rondeel	Midwest Surveys Inc.	Andrew Hunter
Stephen Chan	NovAtel Inc.	Mark Petovello
Tanmaya Varma	Computer Modelling Group Ltd.	JW Kim

ENGO 500 GROUPS 2011/2012

The objective of the ENGO 500 group project course is the development of skills in cooperative research, report preparation and seminar presentation. Students plan and execute a project that must conform with professional requirements. The project must have design, measurement, analysis and presentation components. Submission and defense of progress reports and a final report are required.

Project Title	Group Members	Supervisor
Assessment of GNSS Errors	Omar Al-Emrani, Harry Bal, Mark Horneman, Kevin Doherty	Gao
GNSS Software Development	James Chan, Stephan Normandeau, Pam Starratt, Bryan Leedham	Petovello
GNSS Software Development	Marc Campagne, Alex Ngu, Towfique Ahmed, Ivy To	Lachapelle
Subdivision Design	James O'Neill, Mitch Scheuerman, Collin Marquardt, Paul Deering	Hunter
Internet of Things Application: Environmental measurements with a Quadcopter	Dominika Wcislo, Jungyoung Park, Janna Fung, David Townsend	Liang
Terrestrial Photogrammetry	Bryan Hoang, Alfred D'Mello, Usman Cokar, Alex Hanna	Habib
Terrestrial Laser Scanning	Natasha Wong Ken, Kale Pominville, J-S Gauthier-Mathieu, Brett Vaile	Lichti
Remote Sensing of Wild Fires in Northern Alberta	Derek Eamer, Carey Lavoie, Taylor Butler, Erin Colborne, Andrew Ma	Hassan

GEOMATICS ENGINEERING CAREER DAY

On Thursday, February 02, 2012, the Geomatics Engineering Student's Society and the Department of Geomatics Engineering hosted their sixteenth annual Career Day. Career Day provides a forum for both companies and students to interact and discuss topics and career opportunities in the Geomatics industry.   Several guest speakers made presentations on various topics throughout the day. In addition to these presentations, students and company representatives participated in the Industry Showcase, which was introduced to provide all participants with an opportunity to discuss careers in Geomatics.

The Geomatics Engineering Student's Society would like to thank all participants and sponsors for making this year's Career Day a success.

Career Day Participants 2012

Aerotec LLC	Alberta Land Surveyors' Association
Allnorth Consultants Limited	Association of BC Land Surveyors
Applanix	CDL Systems
Caltech Surveys	Challenger Geomatics
IBI Group	Focus Corporation
Maltais Geomatics	McElhanney Land Surveys Ltd.
Meridian Surveys	Midwest Surveys
Millennium Geomatics	MMM Group
Morrison Hershfield	National Energy Board
NavCom Technology	NovAtel Inc.
Trimble Navigation	Tronnes Surveys
Saskatchewan Land Surveyors Association	Stantec Geomatics Ltd.
Stewart, Weir & Co. Ltd.	Universal Surveys Group

GRADUATE STUDIES

The number of graduate students remained fairly steady with a total of 149 students (139 full-time, 10 part-time.) During the academic year 2011/2012 students were either enrolled in the graduate program or finishing their theses. 80 were working towards their PhD degree, 53 towards their MSc degree and 6 towards their MEng degree. Students originated from 21 different countries. There were 22 students that graduated during the reporting period, 8 with a PhD degree, and 14 with a MSc . Details are given in the following tables.

Full-time PhD Students 2011/2012

Name	Supervisor	Name	Supervisor
Abdizadeh, Mohammad	Lachapelle	Li, Tao	Lachapelle/Petovello
Afzal, Muhammad Haris	Lachapelle	Li, Yihe	Gao
Akpanekong, Aniekan	Barry	Maghsoudi Mehrani, Yasser	Collins
Al-Fanek, Ossama	Skone	Mazaheri Tehrani, Habib	Collins
Al-Rawabdeh, Abdulla	Habib	Mirkhosravi, M. Hossein	Hunter
Ali, Abdelrahman Saad	El-Sheimy/Sesay	Melgaard, Tor Egil	Lachapelle
Amjadiparvar, Babak	Sideris/Kim	Mohammadi, Ehsan	Hunter
Anantharamu, Pratibha	Lachapelle	Mokhtari, Elaheh	Sideris
Attya, Hussein	Habib	Mousavi, Ali	Hunter
Atteia Allah, Ghada	Collins	Moussa, Adel, Mohamed	El-Sheimy
Attia, Mohamed	El-Sheimy	Poncos, Valentin	Collins
Baek, Jin	Kim	Poorazizi, Mohammad	Habib
Chan, Tin On	Lichti	Pooyandeh, Majeed	Marceau
Chang, Hsiu-Wen	El-Sheimy	Rao, Vyasaraj Guru	Lachapelle
Chen, Hsiang Yun	Liang	Ren, Tiantong	Petovello
Chow, Jacky	Teskey/Lichti	Renaudin, Erwan	Habib
Chowdhury, Ehsan	Hassan	Roux, Lani	Barry
Daneshmand, Saeed	Lachapelle	Sadrieh, Nima Seyed	Lachapelle
Detchev, Ivan	Habib	Saeedi, Sara	El-Sheimy
Dhital, Anup	Lachapelle	Satyanarayana, Shashank	Lachapelle
Du, Shuang	Gao	Saylam, Kutalmis	Habib
Ebeling, Axel	Teskey	Sewornu, Rita Esinu	Barry
Eid, Hassan Elsaid	El-Sheimy	Shafiee, Mahsa	Lachapelle/O'Keefe
ElGhazouly, Ahmed Adel	El-Sheimy	Sheta, Bassem Ibrahim	El-Sheimy
El-Sharkawy, Ahmed	El-Sheimy	Shi, Jun bo	Gao
Ghafoori, Fatemeh	Skone	Sokhandan Asl, Negin	Lachapelle
Hassan, Essam Hassan	Habib	Steiner, Harald	Habib
He, Zhe	Lachapelle/Petovello	Taghvakish, Sina	Collins
Huang, Chih-Yuan	Liang	Tang, Feng	Sideris/Gao
Ibrahim, Sherif Mohamed	Lichti	Teskey, Wesley	El-Sheimy
Jafarnia Jahromi, Ali	Lachapelle/Nielsen	Umana-Diaz Alejandra	Collins
Kabirzadeh, Hojjat	Sideris	Urquhart, Landon A	Skone
Kahr, Erin	O'Keefe	Wang, Da	O'Keefe
Kamel, Ahmed Mohsen	Lachapelle/Nielsen	Wang, Fang	Marceau
Kersting, Ana Paula	Habib	Wijesekara, Gayan Nishad	Marceau
Kim, Kwangbae	Kim	Xie, Peng	Petovello
Kwak, Eunju	Habib	Xu, Feng	Gao
Lahamy, Herve David	Lichti	Zhang, Chengqian	Collins
Lari, Zahra	Habib	Zhao, Xing (Bob)	El-Sheimy
Lui, Ren-Yu	Liang	Zhuang, Yuan	El-Sheimy
Lin, Tao	Lachapelle		

Full-Time MSc and MEng Students 2011/2012

Name	Supervisor	Name	Supervisor
MSc Students			
Ahmed, Tanvir	Lichti	Mohammadi, Ehsan	Hunter
Ahn, Ji Young	Kim	Molero, Richard	Barry
Akther, Shammi Musa	Hassan	Mosstajiri, Tina	Kim
Alsubaie, Naif Muidh	El-Sheimy	NematAllah, Heba	El-Sheimy
Aminian, Behnam	Lachapelle/Petovello	Ortiz, Andres	Habib
Ang, Joshua	Teskey	Phillips, Andrew	Liang
Asiedu, Kwame	Barry	Qi, Xiaojuan	Lichti
Bhaskar, Srinivas	Lachapelle	Rahimi, Seyed	Wang
Bliss Taylor, Coral	Hunter	Rahman, Kazi Mahmudur	Hassan
Canaz, Sibel	Habib	Rezel, Rohana Deshapriya	Liang
Chan, Billy Cheuk Wai	Petovello	Sekhon, Navdeep Singh	Hassan
Chan, Ting On	Lichti	Shunnar, Thaer	Barry
Danso, Ephraim Newman	Barry	Siddharth, Siddharth	El-Sheimy
Denbina, Michael William	Collins	Susi, Melania	Lachapelle
Farjad, Babak	Marceau	Swab, Michael	Skone/O'Keefe
Fraser, Scott	Marceau	Tamazin, Mohamed Essam	Lachapelle
Haddad, Oday Issam	Skone	Tiwari, Rajesh	Skone
Huang, Bei	Gao	Tsai, Han-Fang	Liang
Ince, Elmas Sinem	Sideris	Wang, Baijie	Wang
Islam, Mohammed Shariful	Hassan	Wang, Boxiong	Petovello
Jazayeri, Seyyed	Liang	Wang, Fei	Wang
Jiang, Yuhang	Petovello/O'Keefe	Wang, Jing	Wang
Kersting, Juliano	Hunter	Winit, Rasika	O'Keefe
Keshvadi, Hatef	Lachapelle/Broumandan	Zaman, Tasnuva	Sideris
Knoechel, Ben Charles	Liang	Zheng, Botao (Shirley)	Marceau
Ma, Martin	Lachapelle	Zhou, Dequan	Wang
MEng Students			
Al-Sadat, Mazen Abdullatif	El-Sheimy	Li Bo	O'Keefe/Marceau
Farooqi, Iftikhar	Lichti	Liakopoulos, Alexandros	Sideris
Hadavand, Zahra	Sideris	Umbarila, Gloria	Marceau

Part-time Graduate Students 2011/2012

Name	MEng	MSc	PhD	Supervisor
Bobye, Michael James		1		El-Sheimy
Ching, Kwan Kit (Stephen)	1			Lachapelle
Egbulefu, Irene Folashade		1		Barry
Kent, Steve		1		Blais
Luo, Ping		1		Petovello
Morin, Kristian Walker			1	Lichti
Radons, Charlene Marcia	1			Skone/O'Keefe
Troyer, Brady Ross	1			Lachapelle
Wang, Min			1	Gao
Zhang, Wentao			1	Gao

Dr. Jan Skaloud, Senior Research Fellow and lecturer at Ecole Polytechnique Federal Lausanne, Switzerland and an alumnus of our department, taught the Tecterra sponsored course, ENGO 699.55 — 'Special Studies in Integrated Sensor Orientation'.

Graduate Studies Convocants 2011/2012

Name	Degree	Date	Graduate Thesis Title	Supervisor
Muhammad Haris Afzal	PhD	Jun 11	Use of Earth's Magnetic Field for Pedestrian Navigation	Lachapelle
Mazen Abdullatif Al-Sadat	Meng	Jun 11	N/A	El-Sheimy
Wesley J. E. Teskey	PhD	Jun 11	Assessment and Attenuation of Movement Disorder Motion Using Inertial Sensors	El-Sheimy
Hassan Elsaid Elhifnawy Eid	PhD	Jul 11	Automated Urban Features Classification and Recognition from Combined RGB/LiDAR Data	El-Sheimy
Scott Fraser	MSc	Jul 11	Estimating Intake Fraction by Loose-Coupling an Air Dispersion Model and a Geospatial Information System	Marceau
Mohamed Essam Hassan Rosdy Tamazin	MSc	Jul 11	Benefits of Combined GPS/GLONASS Processing for High Sensitivity Receivers	Lachapelle
Ahmed Mohsen Mohamed Saeed Kamel	PhD	Jul 11	Context Aware High Dynamics GNSS-INS for Interference Mitigation	Lachapelle
Musa Shammi Akther	MSc	Aug 11	Remote Sensing-Based Framework for Forecasting Forest Fire Danger Conditions Over Boral Forest	Hassan
Navdeep Singh Sekhon	MSc	Aug 11	Remote Sensing-Based Determination of Boreal Spring Phenology in Alberta	Hassan
Pratibha Bangalore Anantharamu	PhD	Sept 11	Space-Time Equalization Techniques for New GNSS Signals	Lachapelle
Oday Issam Haddad	MSc	Sept 11	WAAS Integrity Investigation for Canadian Latitudes	Skone
Mohammad Hatef Keshvadi	MSc	Sept 11	Spatial Characterization of Multipath GNSS Channel	Lachapelle
Ehsan Mohammadi	MSc	Sept 11	Indoor Location Based Services	Hunter
Kazi Mahmudur Rahman	MSc	Sept 11	Remote Sensing-Based Determination of Deciduous and Understory Phenology Over Boreal Forest	Hassan
Rohana Deshapriya Rezel	MSc	Sept 11	Sensor Web Recommender System—Harnessing Collaborative Intelligence for Geospatial Information Discovery	Liang
Shashank Satyanarayana	PhD	Sept 11	GNSS Channel Characterization and Enhanced Weak Signal Processing	Lachapelle
Thaer Shunnar	MSc	Sept 11	Detecting Fraudulent Activities in Land Record Systems: An Application of Data Mining	Barry
Behnam Aminian	MSc	Oct 11	Investigations of GPS Observations for Indoor GPS/INS Integration	Lachapelle
Elmas Sinem Ince	MSc	Nov 11	Geoid Investigations for the New Vertical Datum in Canada	Sideris
Ting-On Chan	MSc	Dec 11	Feature-based Boresight Self-Calibration of a Mobile Mapping System	Lichti
Ana Paula Baungarten Kersting	PhD	Dec 11	Quality Assurance of Multi-Sensor Systems	Habib
Yasser Maghsoudi	PhD	Dec 11	Analysis of Radarsat-2 Full Polarimetric Data for Forest Mapping	Collins
Siddharth Siddharth	MSc	Jan 12	An Intelligently Tuned Orientation Estimation for Pedestrian Dead Reckoning Using Handheld Devices	El-Sheimy
Andrés R. Ortíz Villagómez	MSc	Apr 12	Local Alignment Applied to Grizzly Bear GPS Tracking Data	Hunter

Graduate Seminars 2011/2012

| Speaker	Topic
Kazi Mahmudur Rahman	Determining of Deciduous Phenology using Remote Sensing Data
Majeed Pooyandeh	An Agent-Based Model to Simulate Stakeholders' Interactions in the Context of Land-Use Intensification, Climate Change, and Water Resource Management in the Elbow River Watershed in Southern Alberta.
Sina Taghvakish	Harvest Detection Using PolSAR Data.
Mussa Shammi Akther	Use of Remote Sensing in Forecasting Forest Fire Danger Conditions
Melania Susi	Gait Analysis from Handheld Device.
Mohamed Attia	Map Aiding indoor and outdoor Navigation Applications.
Fatemeh Ghafoori	Investigating and Quantifying the Impact of Ionospheric Scintillations on GPS Receiver Carrier Tracking Loop Performance.
Ana Kersting	Quality Assurance of Multi-sensor Systems.
Feng Xu	A Vector Tracking Loop for GNSS Receiver.
Erwan Renaudin	Evaluation of Airborne POLInSAR System for Deriving 3D Forest Structure.
Eunju Kwak	Automatic 3D Building Model Generation by Integrating LiDAR and Aerial Images using a Hybrid Approach
Ting On Chan	Feature-based Self-Calibration of a Mobile Mapping System.
Tor Melgard	Interchangeable Integration of GPS and GLONASS by Using a Common System Clock in PPP.
Peng Xie	Multipath Signal Assessment in the High Sensitivity Receivers for Vehicular Applications.
Jacky Chow	Multi-Sensor Integration for 3D Indoor Reconstruction.
Sara Saeedi	Context Aware Mobile Personal Navigation Services Using Multi-Level Sensor Fusion.
Siddharth Siddharth	A New Sensor Fusion PDR Algorithm for Hand-Held Devices
Ahmed El-Sharkawy	Multi-Resolution Techniques for Edge Detection and Feature Extraction from 8-Bands High Resolution Satellite Imagery.
Feng Tang	Determination of Mean Sea Level and its Trend in West and East of Canada by Combining Satellstry Data and Tide Gouge Data.
Jin Baek	Modeling of Albertan Unconventional Oil Field by Integrated Satellite and Geodetic Measurements.
Yasser Maghsoudi	Using Radersat-2 Polarimetric Data for Forest Mapping.
Andres Ortiz	Review of Implementation and Results of Three Cluster Detection Methods Applied to Data Mining of Grizzly Bear Tracking Datasets.
Mohammad Abdizadeh	Position Domain Interference Mitigation Performance of Adaptive Linear Phase FIR Notch Filter for Multiple Narrowband Interference Situation
Ali Jafarnia Jahromi	GNSS Anti-Spoofing
Ahmed Elghazouly	Multi Resolution Spectral Techniques for DGPS Errors, Analysis and Mitigation.
Tao Lin	Implementation and Performance Analysis of a Maximum-Likelihood Vector-Based GNSS Receiver
Mahsa Shafiee	Using WiFi Signals in GPS Positioning Systems
Nishad Wijesekara	Calibration and Validation of MIKE-SHE Hydrological Model for the Elbow River Watershed, in Southern Alberta
Saeed Daneshmand	GNSS Interference and Multipath Suppression using Array Processing
Anup Dhital	High-Integrity Positioning in Signal Degraded Environments through Integrated Navigation System.
Habib Mazaheri	Soil Moisture Estimation Using Radarsat-2 Data.
Negin Sokhandan	High Resolution Time of Arrival Estimation in Multipath Environments for GNSS Applications.
Ephraim Danso	A Case Study on Peri Urban Land Tenure and Land Administration in Ghana.
Tao Li	Use of DR to Improve Performance of Ultra-Light GPA/Vehicle Sensor Integrated System
Seyed Mina Sadrieh	A Weighted Combing Method for GNSS Antenna Diversity
Lani Roux	Land Transactions in Social Housing in the Western Cape of South Africa: A Case Study of Kransdorp
Fang Wang	Simulating Land-Use Changes at a Fine Spatial Scale Using an Integrated Cell/Patch Cellular Automata Model
Eunju Kwak	Automatic 3D Building Model Generation by Integrating LiDAR and Aerial Images using a Hybrid approach
Da Wang	Multi-Vehicle Relative Positioning Using GNSS Carrier Phase Integrated with Ultra-wide Band Range and Bearing Data
Baijie Wang	Reservoir Characterization and Horizontal Well Placement Guidance Acquisition by using GIS Assisted Data Mining Methods
Sina Taghvakish	Harvest Detection Using PolSAR Data
Junbo Shi	Improvement of PPP-Inferred Troposphere Estimates by Integer Ambiguity Resolution
Zhe He	Modelling HSGPS Dopplers for Integrating with PDR Sensors

RESEARCH

Research Statistics

Research is an integral part of Department activities. It allows individual faculty members to stay at the leading edge of their area of specialization and to apply their knowledge to current problems in industry and government. It also provides funding for research associates and graduate students. It thus supports the education of highly trained future engineers and the teaching activities of the Department.

Direct research funding for this report year was at **$5,883,979.**

Direct Research Funding by Source
## 2005/06 to 2011/12
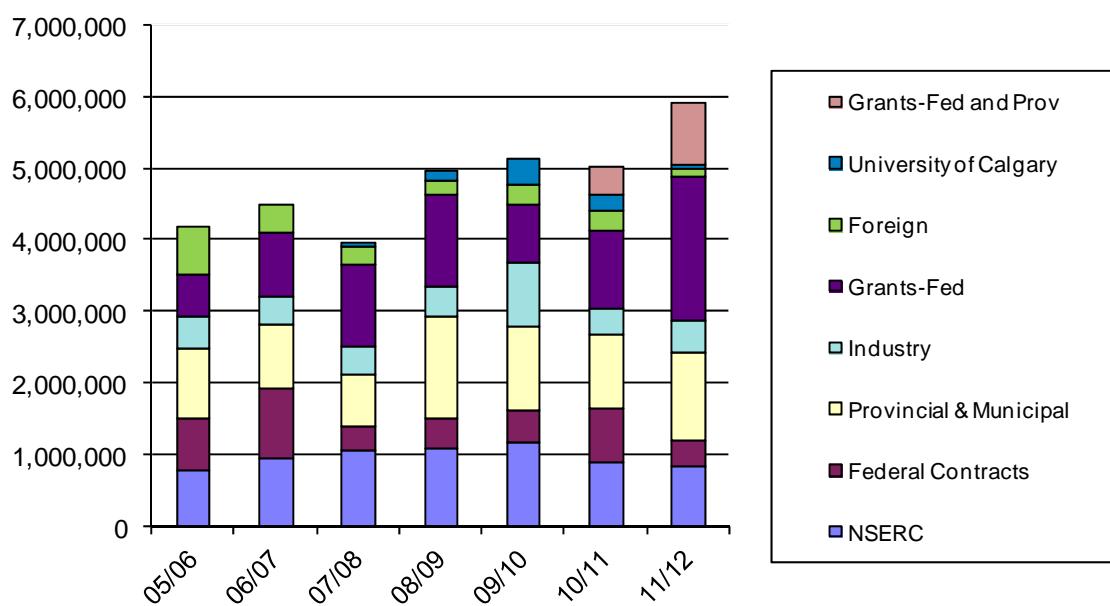
Research Grants and Contracts for the Period
April 1, 2011 – March 31, 2012

Source	Amount
Contracts—Federal	$353,139
Foreign	97,020
Grants—Federal	2,018,460
Industry	456,346
Provincial and Municipal Government	1,214,046
NSERC	825,771
Unclassified	853,477
University of Calgary	65,720
Total Research Support	$5,883,979

The figure on the previous page shows direct research funding for the last seven years and the one below shows the research funding by Area for 2011/2012

Direct Research Funding by Area 2011/12
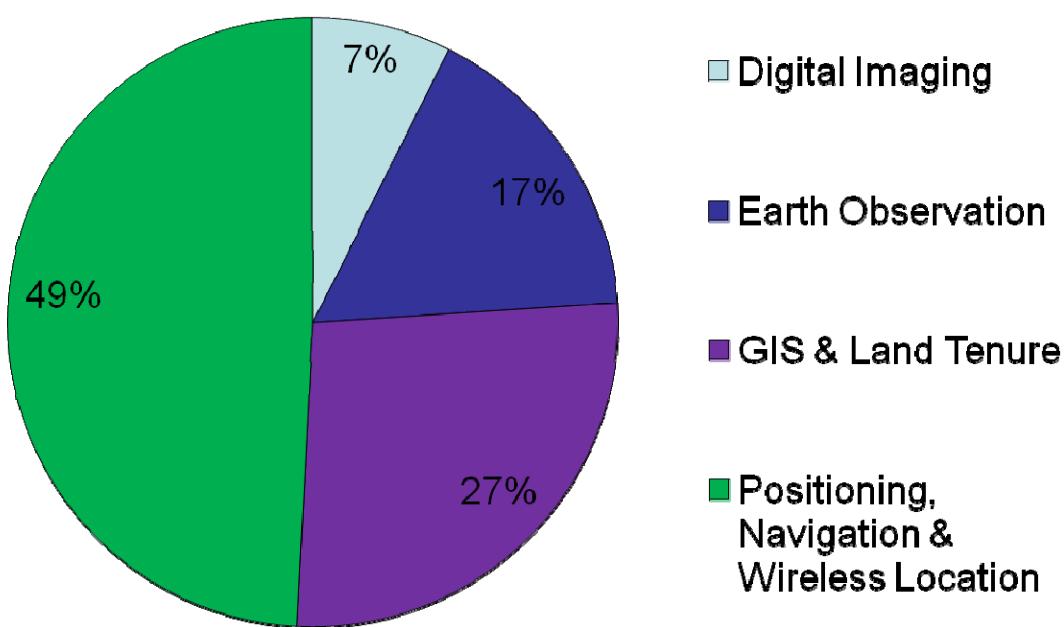
MAJOR RESEARCH AREAS

Positioning, Navigation and Wireless Location

N. El-Sheimy, Y. Gao, G. Lachapelle,
K. O'Keefe, M. Petovello, S. Skone, W. Teskey

Earth Observation

M. Collins, Q. Hassan,
J.W. Kim, M. Sideris

GIS and Land Tenure

M. Barry, A. Hunter, S. Liang,
D. Marceau, X. Wang

Digital Imaging Systems

A. Habib, D. Lichti

Graduate Student Distribution by Area
May 2011—April 2012

- GIS and Land Tenure: 32
- Earth Observation: 25
- Positioning, Location: 62.5
- Digital Imaging: 27.5
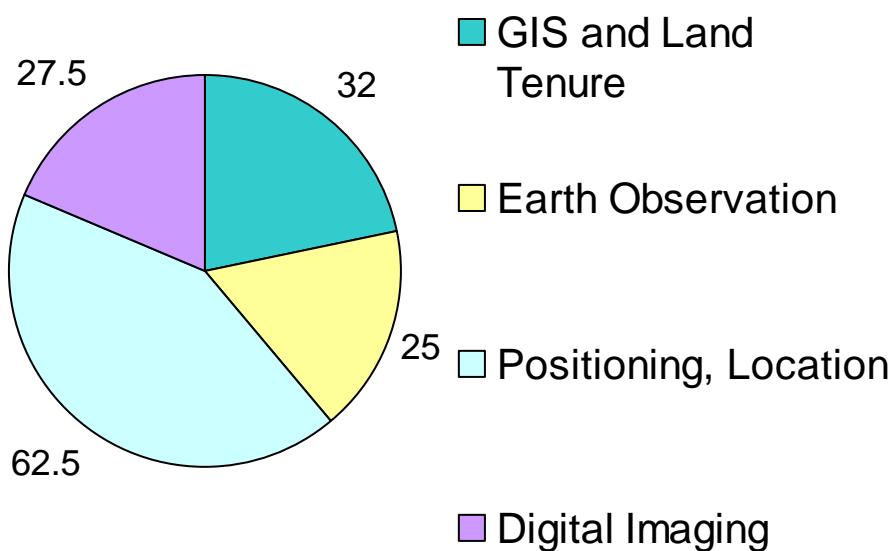
Research projects being conducted in the above major research areas are listed in tables on pages 36 to 40.

The number of graduate students working in each area is indicated in the above figure.

# Projects in Positioning, Navigation and Wireless Location

Project Name	Contract Type	Faculty Investigators
Adaptive Integration Techniques for Low-cost Integrated Navigation Systems	NSERC	N. El-Sheimy
Advanced Carrier-phase GNSS and Integration with Ground-Based RF-ranging Systems	NSERC	K. O'Keefe
Advanced GNSS Signal Processing Techniques for Indoor Location	NSERC	G. Lachapelle
Alpine Canada Alpine Sponsorship Agreement	Industry	G. Lachapelle
Canada Research Chairs Program	Federal	N. El-Sheimy
Canada Research Chairs Program	Federal	G. Lachapelle
Collaborative Signal Tracking for Improved Satellite Navigation	Provincial	M. Petovello
Development of Reconfigurable GNSS Software Receivers	Federal	M.E. Cannon G. Lachapelle M. Petovello
Global Differential GNSS Positioning and Navigation	NSERC	Y. Gao
GNSS Software Receiver Development and Ultra-Tight Integration with Inertial Sensors	NSERC	M. Petovello
GPS-Electronic Monitoring Applications Study	Provincial	G. Lachapelle
GPS Location Technologies for Personal Digital Assistants	Provincial Industry NSERC	G. Lachapelle M. Petovello
GPS Location Technologies for Personal Digital Assistants NSERC CRD 2009 AAET Industry Sponsored Collaborative Project - "Enhancements of Personal Digital Assistant Location"	Provincial	G. Lachapelle M. Petovello
ICT Top-Up Award	Provincial	K. O'Keefe
Integration of Satellite AIS with EO Based Maritime Security Services SCUTUM	Foreign	K. O'Keefe G. Lachapelle
Investigation of Potential Interference of High Voltage Power Lines on GNSS	Industry	G. Lachapelle
Low-cost GNSS PPP and MEMS IMU Integration and Prototype System	Unclassified Foreign	Y. Gao
Low-cost High Precision Indoor/Outdoor 3D Laser Scanning	NSERC Industry	W. Teskey
Multi-Sensor Systems for Tracking and Mobility Applications	Federal	N. El-Sheimy
Multi-Vehicle Tracking Using GNSS Integrated with Ultra-wideband Range and Onboard Orientation Sensors	NSERC Industry Federal	K. O'Keefe M. Petovello

Projects in Positioning, Navigation and Wireless Location, continued

Project Name	Contract Type	Faculty Investigators
Next Generation Multi-Sensor Systems for Personal Navigation in Challenging GPS Environments	NSERC	N. El-Sheimy
Professional Services Contract	Federal	S. Skone
Tecterra Research Support	Unclassified	N. El-Sheimy
Tecterra Internal Funding	Unclassified	N. El-Sheimy
The Resolute Bay Incoherent Scatter Radar: A Space Science Initiative in Nunavut	Federal Provincial	S. Skone
Ultra-Tight Integration of GPS with Vehicle Sensors for High Sensitivity Navigation	Industry NSERC	M. Petovello

Dr. Elhabiby at the Subterranean room 120ms under the Great Pyramid- Graviemtry Measurements
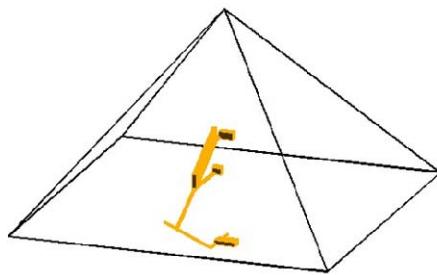
The interior of the great pyramid (King, Queen and Subterranean Chambers and all the connecting tunnels)

Projects in Digital Imaging Systems

Project Name	Contract Type	Faculty Investigators
A Comprehensive, On-Line Terrestrial Laser Scanning Bibliography	Foreign	D. Lichti
A Hands-free Interactive System for Manipulating Object-Oriented Information Within Networked Virtual Environments	NSERC	D. Lichti
Automated Feature Extraction from Multi-Modal Imagery for Corridor Transport Mapping	Unclassified Industry	A. Habib
Detchev, Ivan	Provincial	A. Habib
Development of Innovative Tools for LiDAR Mapping	Federal	A. Habib D. Lichti
Development of Innovative Tools for Quality Assurance, Quality Control, and Object Recognition for Terrestrial and Airborne LiDAR Mapping	Industry	A. Habib D. Lichti
Development of Innovative Tools for Quality Assurance, Quality Control, and Object Recognition for LiDAR Mapping	Federal Industry Unclassified	A. Habib D. Lichti
Geometric Modelling of 3D Laser Cameras for Biomedical Applications	NSERC	D. Lichti
Innovation Tools for Ground-Based LiDAR Mapping	Unclassified	A. Habib D. Lichti
Integration of Multi-Sensory Data for Realistic Reconstruction of 3D Urban Environments	NSERC	A. Habib
Internal Research Support—3D Imaging	U of C	D. Lichti
Scanner Calibration Software Design	Industry	D. Lichti
Structural Health Monitoring System and Methodology for Bridges and Road Network	NSERC	A. Habib D. Lichti
Three-Dimensionalizing Surveillance Networks	Federal	A. Habib

Ed Parsons' Presentation

To promote Geomatics Engineering to first year engineering students, Tecterra sponsored a "Lunch with Google" event. Ed Parsons, Google's Geospatial Technologist, made an excellent presentation that was attended by more than 150 participants including close to 80 first year engineering students.

Projects in Earth Observation

Project Name	Contract Type	Faculty Investigators
Airborne Gravity Gradiometer System for Exploration of Minerals, Oil and Gas	Unclassified	N. El-Sheimy M. Sideris
Alberta Innovates	Provincial	M. Collins
Forest Landscape Information System	NSERC	M. Collins
GEOIDE NCE Project SII-PIV-50: A Geoide-based Vertical Reference Frame for Height Modernization in North America	Federal Unclassified	M.G. Sideris
Geomagnetic Field Modeling from On-Board LEO Attitude Control Magnetometer	NSERC	J.W. Kim
Geotechnical Subsurface Modeling by Soft Computing Method	Foreign	J.W. Kim
Height Modernization in North America SII-PIV-50	Federal	M. Sideris
Integrated Gravimetric & Geodetic Monitoring of Geological CO_2 Storage	Federal Industry	M. Collins J.W. Kim M. Sideris
Monitoring Agricultural Land Management Activities from Space	Federal Unclassified	M. Collins
Multi-Satellite Determination of Global and Regional Geoid and Sea Level Changes	NSERC	M. Sideris
Remote Sensing-based Forest Fire Occurrence Prediction System	NSERC	Q. Hassan
Review of the Scientific Literature on Determining Seasonal Accumulation of Snow Depth and Snow Equivalent Water Primarily Using Remote Sensing-Based Techniques.	Provincial	Q. Hassan

Projects in GIS and Land Tenure

Project Name	Contract Type	Faculty Investigators
A Web-based Spatial Decision Support System for Water Management in Alberta	Unclassified Provincial	D. Marceau
A Scenario Planning Model to Forecast Land Use Intensification and Mitigation Measures of Alberta Woodland Caribou	Unclassified Federal Industry	D. Marceau
Canada Research Chairs Program	Federal	N. El-Sheimy
Development of an Agent Based Model to Assess the Industry -Induced Impacts on Woodland Caribou Habitat Selection and Use in Alberta Accelerate Internship Program	Federal	D. Marceau
Discovering Relationships Between Steam Injection Operations and Oil Production for Husky Tucker SAGD	NSERC	X. Wang
Elbow River Watershed MIKE-SHE Model Enhancement and Scenario Modelling	Provincial	D. Marceau

Projects in GIS and Land Tenure

Project Name	Contract Type	Faculty Investigators
Enhanced Cyclic Solvent Process (ECSP) for Thin Heavy Oil Reservoirs	Industry	X. Wang
GeoCens: Geospatial Cyber Infrastructure for Environmental Sensing	Federal	S. Liang
Historical Land-Use Maps for the South Saskatchewan Regional Plan Area	Provincial	D. Marceau
Huang Chih-Yuan	Provincial	S. Liang
Improved Global Web May Visualization	Federal	S. Liang
Incorporating Domain Knowledge in Spatial Clustering	NSERC	X. Wang
Intelligent Data Mining for Wormhole Reservoir Characterization	NSERC Industry	X. Wang
Internship Junbo Shi—Single Frequency RTK Technologh for Handheld GPS	Industry	X. Wang
John Holmlund Chair in Land Tenure and Cadastral Systems	Industry	M. Barry
Local Climate Change Visioning Tools and Processes for Community Decision-Making	Federal	D. Marceau
Mining Association Rules from Tucker SAGD Database	Federal	X. Wang
Multi-Sensor Systems for Tracking and Mobility Applications	Federal	A. Hunter
Plan Your Place: A Geospatial Cyber Infrastructure for Sustainable Community Planning	Federal Unclassified	A. Hunter
Positionement Geocodage et navigation a l'interieur des batiments	Federal	A. Hunter
Post-Secondary Investment Scholar Grant	Provincial	S. Liang
Recommending Food Based on Online Social Networks & Locations for Food.ee Project	NSERC	X. Wang
Schulich Chair in Geospatial Information Systems and Environmental Modelling	U of C	D. Marceau
Sense-Able GIS: An P2P-Based Interoperable Spatial Sensor Web Architecture	NSERC	S. Liang
Single Frequency RTK Technology for Handheld GPS	Federal	X. Wang
Spatial Dynamic Modeling for Environmental Recourse Management	NSERC	D. Marceau
TrafficPulse SII-PIV-89	Federal	A. Hunter S. Liang
TrafficPulse: A Participatory Mobile Urban Sensor Web for Intelligent Green Transportation	Municipal Unclassified	S. Liang
Traffic Pulse	Federal	S. Liang
Utility Corridor Hazard Assessment Tool	Industry	D. Marceau
Using Data Mining Methods to Optimize Steam Injection Processes for Alberta Oil Sands Production	U of C	X. Wang
Using Two-Step Fuzzy Ranking and Artificial Neural network for Steam Assisted Gravity Drainage (SAGD) Reservoir Characterization	Industry	X. Wang
Water and Environment Hub Project	Federal	S. Liang

LICENSES AND PATENTS

Afzal, H, V. Renaudin and G. Lachapelle (2012) System and Method for Gyroscope Error Estimation. Submitted to the U.S. Bureau of Patents.

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Ellum, C., and N. El-Sheimy, BUNDLE Software— software package that performs self-calibrating Photogrammetric Bundle^{TM} adjustments and terrestrial network adjustments. Licensed by Innovate Calgary.

Gao, J., M.E. Cannon, M.G. Petovello, K. Nagamiya, I. Maeda, K. Kagawa (2009) *Vehicular Navigation and Positioning System*, Patent # 2649990 issued by Canadian Intellectual Property Office in December 2009.

Gao, Y., P3^{TM} – Precise Point Positioning. Licensed by University Technologies International.

Julien, O., C. Macabiau, M. E.Cannon and G. Lachapelle (2008) BOC Signal Acquisition and Tracking Method and Apparatus, European Patent # EP 1598677B1. United Stated Patent # 7,916,771 issued in March 2011.

Lachapelle, G, M. Petovello, C. O'Driscoll and D. Borio (2007-2012) GSNRx™ - GNSS Software Receiver. Developed by the PLAN Group

Nielsen, J, G. Lachapelle and A. Broumandan (2009) Signal Detection in Fading Environments, submitted to the U.S. Bureau of Patents.

Nielsen, J, G. Lachapelle and A. Broumandan (2009) Handheld Synthetic Antenna Array, submitted to the U.S. Bureau of Patents.

Nielsen, J, G. Lachapelle and A. Broumandan (2011) Method and System for Detecting GNSS Spoofing Signals. U.S. Bureau of Patents Number 7,952,519 B1.

Ong, R., G. Lachapelle and M.G. Petovello PLANSoft™ (2010) C++ software for GPS/ GLONASS carrier phase kinematic positioning.

Petovello, M.G., M.E. Cannon and G. Lachapelle, SAINT™- software for the integration of GPS and inertial measurement units.

Petovello, M.G. and G. Lachapelle (2006) A new method of Doppler Removal and Correlation for Software GNSS receivers. Patent #7,679,551, U.S. Bureau of Patents, Issued March 2010.

Schwarz, KP and N. El-Sheimy, KINGSPAD (KINematic Geodetic System for Positions and Attitude Determination) Software. A GPS/INS Integration Software for Navigation and Mapping Applications. Licensed by Innovate Calgary.

Shin, E. and N. El-Sheimy, AINS^{TM}—Aided Inertial Navigation Software, Matlab Tool Box for GNSS/INS Integration using EKF, UKF, and Backward Smoothing. Licensed by Innovate Calgary.

Skone, S., TECMODEL Software, Licensed by University Technologies International.

Yang, Yong and N. El-Sheimy, Inertial Simulator—An Inertial Navigation Simulation Tool, 2007. Licensed by University Technologies International.

ACADEMIC AND PROFESSIONAL SERVICES

M. Barry
- John Holmlund Chair in Land Tenure and Cadastral Systems
- GIM International Magazine Editorial Team
- Director, Federation Internationale des Geometres (FIG) Foundation
- Federation Internationale des Geometres (FIG) Special Task Force on Africa
- Canada Representative, Federation Internationale des Geometres (FIG) Commission 7
- Canadian Institute of Geomatics (CIG) Certification Committee
- Geomatics Engineering Liaison Committee
- The University of Calgary Faculty Association (TUCFA), Geomatics Department Representative
- The University of Calgary Faculty Graduate Scholarship Committee

M. Collins
- APEGGA, Board of Examiners
- APEGGA Committee on Aboriginal Affairs
- Associate Editor, International Journal of Remote Sensing
- Reviewer for several technical journals
- Reviewer for NSERC grant proposals

N. El-Sheimy
- Canada Research Chair in Mobile Multi-sensor Geomatics Systems
- Scientific Director, TECTERRA
- President, Technical Commission I, International Society for Photogrammetry and Remote Sensing (ISPRS)
- Technical Program Chair, Co-Chair and Member of the Organizing Committee for a number of national and international conferences
- Member of the Editorial Board of Journal of Survey Review, Coordinates, and Journal of Applied Geodesy

Y. Gao
- Advisory Board, Association of GNSS Technology and Application in China
- Board of Directors, International Association of Chinese Professionals in Global Positioning Systems
- Chairman, IAG Sub-Commission 4.5 "High Precision GNSS Algorithm and Applications"
- Special Examiner, Board of Examiners for Canada Land Surveyors
- Associate Editor, IEEE Transactions on Vehicular Technology
- Editorial Board, Journal of Global Positioning Systems
- Editorial Board, Geospatial Information Science
- Reviewer for refereed journals and grant applications
- Session chair and program committee members for international conferences

A. Habib
- Professor (Status only), Department of Civil Engineering, University of Toronto
- Adjunct Professor, National Cheng Kung University, Taiwan
- Associate editor, Geomatica Journal (Photogrammetry)
- Member, GEOIDE Research Management Committee (RMC)
- Member of the Editorial Advisory Board for The Global Magazine for Geomatics GIM International, GIM International
- Member of the Editorial board of the Korean Journal of Civil Engineering
- Member, Editorial Board of the Journal for the Korean Society of Surveying, Geodesy, Photogrammetry, and Cartography
- Member, Editorial Board of the Brazilian Journal of Cartography (RBC) in the field of Photogrammetry and Remote Sensing
- Member, Editorial Board of the Geo-Spatial Information Science (GSIS) Journal
- Chair, ISPRS Working Group I/3 "Multi-sensor and multi-platform inter -calibration"
- Special Examiner for the Canadian Board of Examiners for Professional Surveyors (CBEPS) in the area of Remote Sensing and Applied Photogrammetry & Advanced Photogrammetry

Q. Hassan
- Member, Canadian Remote Sensing Society
- Member, International Society for Environmental Information Sciences
- Reviewer for several technical journals
- Reviewer, IEEE International Geoscience and Remote Sensing Symposium
- Member, Centre for Environmental Engineering Research and Education
- Member for several committees in the Schulich School of Engineering
- Editorial Board Member, Applied Remote Sensing Journal
- Organizer for several technical conferences

A. Hunter
- Academic Member Canadian Board of Examiners for Professional Surveyors Education
- Member, Faculty Undergraduate Studies Committee
- Department Rep Building Committee
- Member Learning and Instructional Development Subcommittee
- Organizing member of local chapter of the Open Source Geospatial Foundation (OSGeo)
- Board Member (Academic) Alberta Geomatics Group

J.W. Kim
- President, Association of Korean Canadian Scientists and Engineers - Calgary Chapter
- Executive. CGU (Canadian Geophysical Union Geodesy Section Members-at-Large)
- Member, AGU (American Geophysical Union)
- Member, IEEE Geoscience and Remote Sensing Society

G. Lachapelle	• Editorial Board, GPS World
	• Programme Committee Member, Ubiquitous Positioning, Indoor Navigation and Location-Based Service, Helsinki, October 2012
	• Scientific Committee Member, International Conference on Indoor Positioning and Indoor Navigation, Sydney (Australia), November 2012
	• Review of papers for numerous journals and review of grant proposals and academic promotion applications worldwide.

S. Liang
- Secretary, the ISPRS Technical Commission I on Image Data Acquisition - Sensors and Platforms
- Chair, Open Geospatial Consortium (OGC) University Domain Working Group
- Co-Chair, the ISPRS Intercommission Working Group on Geo-Sensor Networking and GeoGRID (ICWG IV/II)
- Reviewer for several international journals, books, and research grants
- Chair and co-chair for several international workshops
- Member, Canada Institute of Geomatics, ACM, and APPEGA

D. Lichti
- Chair, International Society for Photogrammetry and Remote Sensing Working Group V/3 Terrestrial Laserscanning and 3D Imaging
- Editorial Board Member, Journal of Spatial Science
- Editorial Board Member, ASCE Journal of Surveying Engineering
- Guest Editor, The Photogrammetric Record Special Issue
- Guest Editor, Remote Sensing Special Issue
- Member: Canadian Institute of Geomatics, Spatial Sciences Institute (Australia)
- Journal reviewer: IEEE Transactions on Geoscience and Remote Sensing, ISPRS Journal of Photogrammetry and Remote Sensing, ASCE Journal of Surveying Engineering, Sensors, Photogrammetric Engineering & Remote Sensing

D. Marceau
- Associate Head of Graduate Studies, Department of Geomatics Engineering
- Member of the Tecterra Scientific Advisory Committee
- Chair of the Post-Graduate Studies Committee, Schulich School of Engineering
- Member of the Steering Committee of the Graduate Faculties Council
- Member of the *Commission on Geospatial Analysis and Modeling, International Cartographic Association*
- Member of the Scientific Committee of the *International Symposium on Cellular Automata Modeling for Urban and Spatial Systems*
- Member of the editorial board of the *Journal of Ecosystem and Ecography*, since February 2012.
- Member of the International Editorial Board of the *International Journal of Society Systems Science*
- Member of the International Editorial Advisory Board of *The Open Environmental Engineering Journal*
- Member of the International Editorial Board of the International Journal of GIS and Spatial Analysis/Revue internationale de géomatique

K. O'Keefe
- Associate Head, Undergraduate Studies
- Vice-chair, Alberta Section of the Institute of Navigation
- Member, Institute of Navigation, Canadian Institute of Geomatics, Canadian Aeronautics and Space Institute
- Member, Faculty Undergraduate Studies Committee
- Faculty Representative, U of C Engineering Endowment Board
- Associate Editor, Canadian Aeronautics and Space Journal
- Editorial Boards, GPS Solutions, Journal of Geodetic Science
- Member, IAG WG 4.5.1 Network RTK, WG 4.5.4 Data Processing of Multiple GNSS Signals
- Reviewer, IEEE Aerospace and Electronic Systems, IEEE Oceanic Engineering, GPS Solutions, International Journal of Navigation and Observation, Journal of Geodesy, Navigation

M. Petovello
- Associate Head (Graduate Studies), Department of Geomatics Engineering since July 2011
- Associate Editor, NAVIGATION: Journal of the Institute of Navigation
- Contributing Editor, Inside GNSS magazine's GNSS Solutions column
- Member, Editorial Board of book titled "Ubiquitous Positioning and Mobile Location-based Services in Smart Phones"
- Chair, Institute of Navigation Alberta Section since Dec 2009
- Member, U.S. Institute of Navigation, APEGGA, IEEE, CIG
- Faculty representative for 2011 undergraduate trip to Switzerland
- Reviewer for six different technical journals

M. Sideris
- Vice President, International Union of Geodesy and Geophysics (IUGG)
- President, International Association of Geodesy (IAG)
- Member, Board of Directors of The University of Calgary Faculty Association (TUCFA)
- Chair, Research Development and Policy Committee (RDPC)
- Member, Bureaus and Executive Committees of the IUGG and the IAG
- Fellow of the IAG and of the International Geoid Service (IGeS)
- Chair, Theme 1 of the Global Geodetic Observing System (GGOS)
- Member, Editorial Board, Journal of Geodesy and Cartography
- Reviewer for the Journal of Geodesy, Geophysical Journal International, Journal of Geodynamics, Geomatica and Journal of Geophysical Research
- External reviewer, NSERC, National Research Council of the National Academies of the USA, European Granting Councils

S. Skone
- GeoScan Iridium Steering Committee
- Chair, Canadian Navigation Society
- CASI Executive Council
- CIG Hydrography Committee
- Board of Directors, Tecterra Inc.
- Board of Directors, GEOIDE

W. Teskey
- Member, Faculty of Engineering Design Fair Committee
- Adjudicator, Graduate Awards Competition, Faculty of Graduate Studies
- Canadian representative to Commission 6 (Engineering Surveys) of the International Federation of Surveys (FIG)
- Member, Publications Committee, Journal of Surveying Engineering

X. Wang
- Program Committee. Advances in Databases and Information Systems (ADBIS) conference, Poznan, Poland
- Program Committee. The 7th International Conference on Rough Sets and Knowledge Technology (RSKT'12). Chengdu, China
- Program Committee. The 16th Pacific-Asia Conference on Knowledge Discovery and Data Mining, Kuala Lumpur, Malaysia
- Program Committee. The 9th International Conference on Fuzzy Systems and Knowledge Discovery (FSKD 2012) and The 8th International Conference on Natural Computation (ICNC 2012). Chongqing, China
- Program Committee. The 25th Canadian Artificial Intelligence Conference (CAI 2012). Toronto, Canada
- Conference Chair. The Second International Workshop on Spatial Information Modeling, Management and Mining (SIM3) in conjunction with DASFAA2012. Busan, South Korea
- Reviewer, IEEE Trans on Knowledge and Data Engineering (TKDE), Intelligent Information Systems, Pattern Recognition, Geomatica
- Committee member, Faculty Gender and Diversity in Engineering Committee (GDEC)
- Member, Canadian Artificial Intelligence Association

Lani Roux interviews South African residents as part of her PhD project investigating the interaction of users and land information systems.

PUBLICATIONS

Books and Chapters

Habib, A., (2011) Modern Photogrammetric Mapping. Advances in Mapping from Aerospace Imagery: Techniques and Applications, Yang, X. and Li, J., Editors, CRC Press, Taylor & Francis Group.

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Straatman, B., and D.J. Marceau (2011) Open-Ended Agent-Based Economic Evolution. In: Advanced Geosimulation Models, D.J. Marceau and I. Benenson, Eds, Bentham Science Publisher, pp. 126-141.

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Afzal, H., V. Renaudin and G. Lachapelle (2011) Multi-Magnetometer Based Perturbation Mitigation for Indoor Orientation Estimation. *Navigation*, 58, 4, 279-292.

Afzal, M., V. Renaudin and G. Lachapelle (2011) Use of Earth's Magnetic Field for Mitigating Gyroscope Errors Regardless of Magnetic Perturbation. *Sensors*, MDPI, 11, 11390-11414, doi:10.3390/s111211390.

Akbar, T.A., Q.K. Hassan, and G. Achari (2011) A Methodology for Clustering Lakes in Alberta on the Basis of Water Quality Parameters. *Clean – Soil, Air, Water*, 39, 916-924.

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Akther, M.S., and Q.K. Hassan (2011) Remote Sensing-Based Estimates of Surface Wetness Conditions and Growing Degree Days Over Northern Alberta, Canada. *Boreal Environment Research*, 16, 407-416.

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Attia, M., A. Moussa, X. Zhao and N. El-Sheimy (2011) Assisting Personal Positioning in Indoor Environments Using Map Matching. *Archives of Photogrammetry, Cartography and Remote Sensing*, 22, 39-49, ISSN 2083-2214.

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Bancroft, J., and G. Lachapelle (2011) Data Fusion Algorithms for Multiple Inertial Measurement Units. *Sensors*, MDPI, 6771-6798.

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Chion, C., P. Lamontagne, S. Turgeon, J.-A. Landry, L. Parrott, D. J. Marceau, C.C.A. Martins, R. Michaud, N. Ménard, G. Cantin, S. Dionne (2011) Eliciting Cognitive Processes Underlying Patterns of Human-Wildlife Interactions for Agent-Based Modeling. *Ecological Modelling*, 222, 14, 2213-2226.

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Curran, J.T., G. Lachapelle, and C. Murphy (2011) An SNR Dependent Model for the CDMA FLL. *IEEE Transactions on Signal Processing*, doi 10.1109/TSP.2011.2178840

Daneshmand, S., A. Jafarnia, A. Broumandan, and G. Lachapelle (2011) A Low Complexity GNSS Spoofing Mitigation Technique Using a Double Antenna Array. *GPS World*, 22, 12, 44-46.

Dehghanian, V., J. Nielsen, and G. Lachapelle (2012) Diversity Gain Through Antenna Blocking. *International Journal of Antennas and Propagation, Hindawi*, Article ID 735080, 6 pages.

Detchev, I., A. Habib, and Y. Chang (2011) Image Matching and Surface Registration for 3D Reconstruction of a Scoliotic Torso. *Geomatica Journal*, 65, 2, 327–335.

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