

# Message from the Head

Building and maintaining a world-class geomatics engineering program takes a lot of work and can only be done by listening and acting on advice from our external stakeholders. From the inception of our program, we have received

valuable advice from our Geomatics Engineering Advisory Committee (GEAC). GEAC most recently met on November 4, 2005 to hear about our achievements and challenges, and to assist us in meeting the needs of

our community. The Department would like to thank our current and past GEAC members for their continued support, guidance and encouragement!

Dr. M. Elizabeth Cannon  
Professor and Head

## Geomatics+Solar Car = Success

Article by BJ Houghton

In November of 2004, a small group of engineering students began designing the first U of C solar car. When designing a solar car, it is important to keep a racing strategy in mind; finding a balance between how much power you are using and how much you need is a problem with many variables. Information about the mechanical and electrical behaviour of the vehicle is important; however, information about the weather, traffic, road conditions and road topography are equally as important. Three undergraduate students from Geomatics

Engineering (Jared Bancroft, Daniel Cook and BJ Houghton) were members of the team responsible for a survey of the race route.

Road topography is used by the mechanical engineers on the team to conduct energy calculations and project the amount of power required to traverse across terrain at a certain speed. Attributes about the race route, such as speed limits, number of lanes, stop signs, intersections and traffic lights are important for race strategy. The length of the initial race route for the North American Solar Challenge (July 2005)

from Austin, Texas to Calgary via Winnipeg was approximately 4000 km. The race route mainly followed secondary highways through the United States and the Trans Canada Highway from Winnipeg to Calgary. The route for the World Solar Challenge (September 2005) from Darwin to Adelaide, Australia was approximately 3000 km.

The set-up that was used to collect location and navigation data was a NovAtel FlexPak OEM4-G2L receiver with a NovAtel GPS-702 antenna. NovAtel graciously donated this receiver to the Solar Car team for use in the future. This receiver was an ideal system for our application as it met our accuracy requirement of <5m (horizontal and vertical) with WAAS corrections. With such a large amount of spatial data to acquire over a 4000 km race route, road profile data and route attributes (stop signs, speed limits, etc.) were

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# Congratulations

- Congratulations to students who defended their theses: Dharshaka Karunanayake, MSc; Li Sheng, MSc; Radoslav Gaidadjiev, MSc; Haitao Zhang, MSc; Qiang Wu, MSc; Nyunook Kim, MSc. Min Wang passed his MEng oral exam.



*Dhar Karunanayake successfully defended his MSc thesis*

- The Honourable David L. Emerson, Minister of Industry and Minister responsible for the Canada Foundation for Innovation (CFI), announced the appointment of Dr. M. Elizabeth Cannon to the Board of Directors of the CFI for a three-year term. The Canada Foundation for Innovation is an independent corporation created by the Government of Canada to fund research infrastructure. The CFI's mandate is to strengthen the capacity of Canadian universities, colleges, research hospitals, and non-profit research institutions to carry out world-class research and technology development that benefits Canadians.

- Geomatics Engineering is pleased to announce that three of its faculty members have been awarded a three-year strategic grant of \$327,300 from NSERC on the research topic of Next Generation Geo-Referencing Technologies for Airborne

Mapping. The research team consists of Drs. Y. Gao (Principal Investigator), A. Habib and N. El-Sheimy.

- The annual Student Awards Night was held Thursday Nov 03 at the University Club. Approximately 100 people attended including a number of industry representatives who presented scholarships to the Geomatics students.



*Student Awards Night, LtoR: Andrew Hunter, Dr. K.P. Schwarz, Elena Rangelova, Mahmoud El-Gizawy, Chen Xu, and Moncton Gao.*

# Student News

- A special lecture was given by Dr. Michael Barry (Nov 18) called "Planning for Informal Settlements" through the Faculty of Environmental Design. Dr. Barry has served on a number of South African government working groups. He has consulted to the United Nations Food and Agriculture Organization (FAO) and the Southern African Development Community Environment and Land Management Systems Programme (SADC-ELMS). He has also served on a number of sub-committees and working groups of the Federation Internationale des Geometres (FIG), and he has been

Vice President of the Council of the Institute of Professional Surveyors of the Western Cape.



*Dr. Barry in Imizamo Yethu ('through collective action - Xhosa) settlement in Cape Town.*

- Grad Expo 2005 is a new fair at the U of C which was hosted by the Faculty of Graduate Studies on November 17 at the Rosza Centre. It is an exposition of graduate programs offered by universities from across Canada. In addition to the U of C, University of Alberta, University of British Columbia, University of Saskatchewan, Simon Fraser University, York University many others attended. Students, graduates and anyone interested in graduate programs were invited.

- The Alberta Land Surveyors Association BBQ was held on November 1 for all first year engineering students.

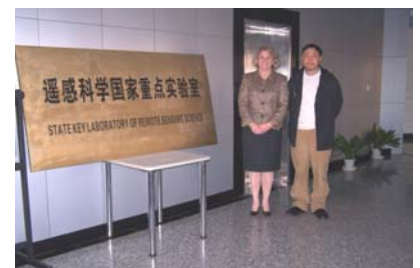
# Visits

- Prof. Chengfa Gao who is with the Department of Surveying and Mapping Engineering, at the Southeast University, Nanjing, Jiangsu, China was here on an Academic visit for three months to conduct research on Precise Point Positioning (PPP) and network RTK.

- The Canadian Engineering Accreditation Board (CEAB) visited the Faculty of Engineering from Oct 23— Oct 25. Dr. Kevin Pegler from UNB was

the Geomatics expert on the visiting team. All undergraduate engineering programs in Canada must be accredited.

- Dr. Elizabeth Cannon visited Wuhan and Beijing, China in December for research meetings and to discuss collaborations. Meetings were held with Prof. Jiancheng Li, Dean, School of Geodesy and Geomatics and Prof. Liu, President of Wuhan University.



*Dr. Elizabeth Cannon and Dr. Peng Gong (who is a former faculty member in our Department) at the Institute of Remote Sensing Applications, CAS/Beijing Normal University*

# Research Spotlight

## Urban growth: predictable and comprehensible?

Article by Dr. Huang Bo (GIS and Land Studies)

Farmlands and other important non-urban land use types in Canada are being lost on a continual basis to sporadic urban



Part of Calgary's urban expansion

expansion. The continually increasing urban sprawl of Canadian cities entails efficient growth management strategies and futuristic measures aimed at sustainable urban development. Although these cities act as the engines driving Canada's economy and overall development, the existing policies and the governmental framework are grossly inadequate to manage the tremendous expansion occurring at a geometric rate. Such an alarming situation calls for the judicious integration of the advances in GIS, spatial statistics and visualization to develop a decision support system to serve urban planners and policy-makers in identifying the desirable and undesirable factors among those that influence urban expansion and perform 'proactive interference' accordingly.

The Intelligent GIS group has been working on designing and implementing a

tool in support of urban growth modeling. Based on spatial statistics, this tool is capable of establishing the spatio-temporal relationship between the change and various causal spatial factors such as roads, facilities, population, and more. This model can then be employed to project the prospective changed scenario. Using the interactive interface provided by the tool, the planners and policy makers can manipulate and visualize the projected multiple scenarios and frame current and future policies in such a way to achieve a desired target that focuses on sustainable development.

This project is aimed at facilitating spatio-temporal statistical modeling and promoting the paradigm of visualization for comprehending different scenarios. The application judiciously integrates GIS and other techniques will be hosted on a distributed geospatial environment with abilities to access, display, query, and analyze the data and generate multiple scenarios. Moreover, the user interface is not a mere static display but facilitates dynamic simulation and querying within a shared collaborative network.

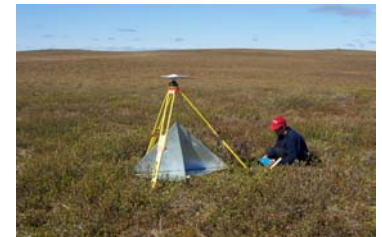
## Deformation Monitoring in Permafrost Regions

Article by Dr. Matthew Tait (Engineering Metrology)

The planned oil and gas extraction in the Mackenzie delta, NT, has increased the need for accurate methods of monitoring vertical displacement in areas of continuous permafrost. Since 2002, studies have been conducted into the most appropriate methods to achieve an annual assessment of surface displacement and underlying natural trend in this region. In

particular, research has been conducted in the areas of (1) Differential Global Positioning (DGPS) levelling with Dr. Elizabeth Cannon, (2) the long-term stability of survey monuments in permafrost, (3) the development and calibration of a novel permafrost heave susceptibility model with Dr. Brian Moorman, and (4) the fitting of krigged surfaces to complex subsidence patterns with sparse data. The next step in this research program is studies into Differential Interferometric Synthetic Aperture Radar (DInSAR) to provide a remote sensing solution to deformation monitoring. This will demonstrate whether or not the current collection and processing methods for DInSAR are suitable for deformation analysis in the tundra regions above the tree-line. Images captured from Envisat and Radarsat-1 of the test area at Reindeer Station, 50km north of Inuvik, NT, will be used to form interferograms and deformation maps that will be compared to conventional survey results gathered in 2004 and 2005.

Dr. Tait will be presenting some of the results of this research at the Calgary regional meeting of the Alberta Land Surveyors on 31 January 2006.



Geo-referencing radar reflectors at the Reindeer Station site.

## Alumni Voice

When I graduated from the Geomatics Engineering program, I didn't know what direction my career would take. Truthfully, I didn't know exactly what I wanted to do. Two and a half years ago, I started with CSI Wireless as an Applications Engineer mostly doing testing, customer support, sales support, manual writing, and providing information for marketing materials, etc. As time went by, I gradually started taking on bigger responsibilities, such as helping to write product definitions and representing the company at trade shows. A year ago, my

supervisor left the company and I took over several of his responsibilities. My title changed to Product Manager and now I am in charge of several products from conception through to production as well as supporting older products. My degree has played a huge role in my career. I use skills learned in university on a daily basis. The more obvious aspects of what I learned during my time at the University of Calgary come to mind immediately: GPS theory, basic electronics and general geomatics knowledge. The more subtle (and sometimes more important) skills fall into

the 'soft skills' category: project management, technical writing and communication. Undoubtedly, the transition from student to professional is difficult, but the University of Calgary Geomatics Engineering program more than adequately prepared me for the challenge.



Amy Dewis, BSc. 2003.



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recorded directly into a MapInfo GIS using some in-house MapBasic scripts to streamline data collection. Once it was all set up it was just a matter of clicking buttons to record attributes to the GIS such as stops signs and rough sections.

Here are some details on the amount of data we collected for the North American Race:  
Traffic Lights - 369 (stopped for only 96 or 26%)  
Stop Signs - 82  
Yield Signs - 31  
Bridges - 242  
School Zones - 34  
Railroad Crossings - 63  
Road Distance Recorded - 4,027km  
Number of GPS Points - 156,067  
Elevation Range - 960 metres (from Mean Sea Level)



It should be noted that all this information was available to all teams during the race in the form of a route book, with road attributes listed as a chainage from the start line. With our in-house survey, we were able to do much more with the data, and were able to produce a daily briefing booklet for the drivers and a road profile for the strategists. The benefit of using our own data was that we knew it was accurate, and we could manipulate it to our requirements. There is a lot of room for improvement of our current system for future Geomatics students to work on, making sure that Geomatics can always make an important contribution to the U of C Solar Car.

## Department Activities

- Dr. Chan Wirasinghe will step down as Dean of the Schulich School of Engineering effective July 1, 2006.
- Julia Millen comes to the role of SCIBERMENTOR Program Administrator (September 29) after being actively involved in the program as a mentor for three years. Her background is in geomorphology and she holds a B.Sc. in physical geography from the University of Calgary. She looks forward to building the

connections she has in the science and education communities, and to forging new ones through the SCIBERMENTOR program. *Welcome Julia!*

- Congratulations to James & Wenya Wang on the birth of their baby girl Jocelyn who was born on October 25, 2005.
- The Geomatics Engineering Liaison Committee (GELC) met on Nov 3, 2005
- The Geomatics Engineering Advisory Committee (GEAC) met on Nov 4, 2005.

- Geomatics Pot Luck Christmas party was held December 20. Lots of international goodies provided.



*Santa visits all the good boys and girls at the Geomatics Department Christmas Party*

## Coming Events

- Departmental Awards Competition—Deadline January 13, 2006
- Career Day—February 2, 2006
- Faculty of Engineering Student Excellence Awards—Feb 19, 2006
- The Schulich Student Activities Fund is now accepting applications for student activities, e.g. student field trips, clubs, teams and associations.
- Look for upcoming information on our fourth year project course presentations.
- Graduate Courses, Winter Schedule: Inertial Surveying and INS/GPS Integration; Advanced Topics in Photogrammetry; Advanced Spatial Information Systems; Environmental Modeling with Spatial Statistics; Geocomputation; Satellite Altimetry; Introduction to Synthetic Aperture Radar; Global Geophysics and Geodynamics.

### Sites to Visit:

- <http://www.novatel.com/>
- <http://www.americansolarchallenge.org>
- <http://www.schulich.ucalgary.ca/SSAF/index.html>
- <http://www.scibermentor.ca/>
- <http://gess.geomatics.ucalgary.ca/>