

# The Geomatics Engineering Program at York University

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## 1.0 Introduction

The Geomatics Engineering program at York University, established in 2001, is one of four, four-year undergraduate Geomatics Engineering programs in Canada. The program was established to provide education opportunities in geomatics engineering and to address the increasing need for geomatics engineering education in Ontario by offering quality, currency and adaptability in geomatics engineering education.

The Geomatics Engineering program offers a four-year Bachelor of Applied Science (B.A.Sc.) degree, along with Masters and Doctorate degrees. The program, housed within the Department of Earth and Space Science and Engineering, is one of four engineering programs (the other three being computer engineering, software engineering and space engineering) at York's School of Engineering.

## 2.0 Program Overview

The challenge for geomatics engineering education is to remain relevant and current vis-à-vis technological developments and to provide fundamental knowledge that will remain imperishable. Emerging trends in geomatics applications, such as contributions to resource exploration, underground utility mapping, climate change, sustainable economic development, environmental monitoring, etc. require not only the “geometry”, but also the “physics” of our ever changing and complex world. Emphasis is given in areas of fundamental knowledge and in areas that experience rapid advancements, and include among others:

- Geodesy as one of the fundamental units within Earth sciences, and as the theoretical foundation of geomatics engineering, precise positioning, geodynamics, and gravity field determination.
- Spaceborne and airborne high-resolution imagery and ranging, hyperspectral data, image analysis, digital mapping, visualization, and 3D modelling.
- Global Navigation Satellite Systems (GNSS) precise positioning and navigation developments, methods and applications.
- Geographic Information Systems (GIS), spatial information technology and communications, web-based developments, location-based services and modern spatio-temporal databases.
- Engineering surveys and in-situ measurements and experiments using integrated electronic field systems, GPS and terrestrial imagery and laser scanners.
- Approximation and estimation methods, quantitative and qualitative data analysis and interpretation.
- Legal framework as related to modern geomatics engineering applications and required by the professional

associations for registration.

The Geomatics Engineering program at York captures the pulse of modern technology, trends and applications. The 18 geomatics engineering courses cover a wide range of disciplines, such as geodesy, geophysics, photogrammetry, remote sensing, GIS, DTM, cadastral surveys and survey law, space science and space sensors, surveying and survey camps, adjustments and data integration, hydrography, Global Navigation Satellite Systems (GNSS), engineering surveys, LiDAR systems, digital imaging and advanced 3D geospatial techniques while giving reasonable options for technical electives in the fourth year of studies.

Between the third and fourth year there is an optional internship program offering geomatics engineering students the opportunity to gain work experience in either the private or public sectors.

## 3.0 Professional Accreditation

The Geomatics Engineering undergraduate program is accredited by the Canadian Engineering Accreditation Board (CEAB) and the Association of Ontario Land Surveyors (AOLS). Therefore, a graduate of the program is eligible to apply for registration as a Professional Engineer (P.Eng.) in Canada and an Ontario Land Surveyor (O.L.S.), which are official titles dictated by law and self-managed by the aforementioned groups. Accreditation assures students that their course material, instructors and academic resources are within the high-quality standards and requirements of the professional bodies, for which their educational “stamp-of-approval” aids in career prospects through industry recognition.

## 4.0 Graduate Studies and Research



High resolution satellite image of York University.

Graduate studies are a source of new knowledge, know-how and scholarly continuity and renewal. The undergraduate program gains substantial benefit from graduate studies and research activities. The development of a graduate program concurrently with the undergraduate one is of significant importance. Our experience is that a parallel graduate program is indispensable for high-level education and training because it allows and promotes crosspollination between undergraduate and graduate students, it stimulates interest and curiosity, and exposes and attracts new students to research and development.

In the information and knowledge-based age, the four-year undergraduate education may not be adequate for students to specialize in a specific direction. In the modern science and engineering societies, graduate studies have become more important for the industrial and academic professional careers than ever before. The existence of a well-organized graduate program provides faculty the opportunity for research, which may bring in considerable amounts of research funding to support Master and PhD students. The role of research is twofold: a) advanced studies and innovation and b) promotion of research to the public via attractive, practical and useful applications.

Faculty members have a wide range of research interests that cover geophysics, geodynamics, geodesy, photogrammetry, remote sensing, engineering surveying, GIS, GNSS, integrated navigation, LiDAR, 3D urban modelling, web-mapping, unmanned aerial mapping systems, etc. Collaborative research activities with the geomatics industry provide long-term benefits to industry and to higher education. Remarkable efforts in research have been made since this program was established. We have experienced and will continuously experience the growth of the research projects and the number of graduate students.

## 5.0 Challenges and Recruitment Initiatives

The geomatics industry has been growing at a dramatic pace and is one of Canada's fastest growing industry sectors. This recent growth is largely attributed to the advancement and development of new technologies. Technological innovations and value-added applications in fields such as satellite-based remote sensing, Geographic Information Systems (GIS) and Global Navigation Satellite Systems (GNSS) are experiencing considerable growth; resulting in both the need and demand for those trained within geomatics.<sup>1</sup> Geomatics engineering professionals have noticed the significant structural change of employment characteristics. There are still plenty of positions in the fields of conventional surveying and mapping. However, more and more geomatics engineering positions are available in high-tech industry or information technology where

the geomatics professionals are involved in the development and manufacturing of software and hardware products in the fields of GIS, GNSS, remote sensing, photogrammetry, ranging technologies and instrumentation.

However, while the demand for the geomatics industry is high, universities across Canada are unable to attract a sufficient number of high school students to geomatics engineering programs; an obstacle which York University's Geomatics Engineering program has not been immune from. These low enrollment numbers are believed to stem from two contributing factors:

1. Lack of understanding about geomatics.
2. Lack of recognition of an existing program at York.

Within this understanding, the ultimate goal for the program is to build awareness of the geomatics industry and to excite and attract high school students to consider a geomatics engineering degree.

In 2009, York University hired an Engineering Student Recruitment Officer to assist in the recruitment process, a role aimed at increasing both student enrollment and geomatics awareness.

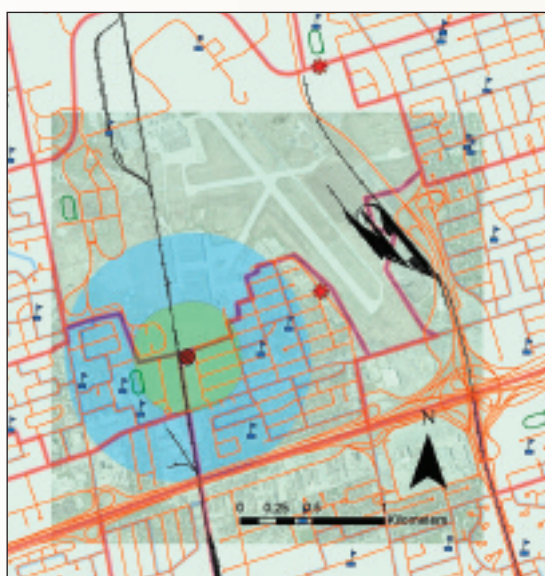
The objective is to ensure program sustainability and to meet the needs of all socioeconomic sectors of the country which require the expertise of geomatics engineers. The Engineering Recruitment Officer delivers an interactive multimedia presentation to grade eleven and twelve physics students in schools across the GTA. The focus is primarily on schools within the Toronto, York, Peel and Durham regions, as the majority of students enrolled in York's Geomatics Engineering program typically reside in these vicinities.

During the first year of this new recruitment initiative, subsequent obstacles in the geomatics field were noted, and the recruitment presentation was further developed to address the following observances.

There is a fundamental necessity to promote the importance of taking math and physics courses in high school, as the number of students taking physics in grade twelve is significantly lower than those in grade eleven. Therefore, students lack the prerequisite courses needed to enter geomatics engineering programs in university.

Furthermore, lack of female enrollment in the sciences needs to be addressed. There is both a recognizable and significant drop in the number of women taking grade twelve physics. To combat this issue, funding models and successful women profiles are used to encourage high school girls to consider a degree in geomatics engineering.

Duly noted was the need for incentives, as such, incentives have since been established to help attract new students to the program. The presentation focuses on scholarships for geomatics engineering students, potential earning salary, technological achievements, possible career pathways as



Spatial impact of the explosion of the propane storage facility in Toronto.

<sup>1</sup> Natural Resources Canada, "Important Facts on Canada's Natural Resources", Earth Science Sector, April 2010, <http://www.nrcan-rncan.gc.ca/stat/geo-eng.php>.

well as contests, prizes and demonstrations to excite and entice students.

Likewise, students typically express interest in careers associated with high level salaries. Using the supply and demand model, the supply referring to the low enrollment of students and the demand being the availability of jobs, the benefits of pursuing the geomatics industry are well emphasized.

Students are also looking for a career that is in high demand. Thus, the presentation has a strong focus on geomatics technological achievements to emphasize the need for geomatics engineers and builds awareness of the various career pathways available to students. While all students and parents are familiar with Google Maps, Google Earth, GPS car navigation systems, etc., nearly all students and parents do not know what geomatics is, thus are unfamiliar with the opportunities available to them.

Yet, while the number of applicants to York University's Engineering programs have directly increased due to the success of the new recruitment initiative, many of the high school students seeking admissions have failed to meet the

minimum admission requirements. As the program continues to grow, new initiatives are required to build further awareness of the geomatics industry and increase and sustain enrollment numbers.

In the subsequent years to come, the Engineering Recruitment Officer will have an increased presence at school hosted parent nights. Our experience from individual school visits and the annual Ontario Universities Fair in Toronto indicates that parents play a large role in the post secondary decisions of the students.

It's apparent that high school teachers and counsellors know little about geomatics, thus it is imperative to increase awareness for these groups as well and provide avenues for them to be further educated; so they may be able to share the information with interested students. Our approach is to host teacher workshops which include on campus lectures and tours. Speaker's bureau presentations by York professors continue to be available throughout the year. In addition, campus tours for students, parents and teachers can be scheduled.



**To schedule a visit for the grade eleven students at your school, please contact: Andrea DiBiase at [adibiase@yorku.ca](mailto:adibiase@yorku.ca). The York website continues to be a valuable source of information for prospective geomatics engineering students and parents: <http://www.science.yorku.ca/Schools-Departments/Engineering/>. Faculty and staff are also readily available and encourage all types of questions: [sciadmist@yorku.ca](mailto:sciadmist@yorku.ca). Information on the Geomatics Engineering program can be found at the York School of Engineering: <http://www.eng.yorku.ca> and the Department of Earth and Space Science and Engineering: <http://yorku.ca/esse>.**