Engineers reach out to First Nations

There has been longstanding under representation of First Nations members in the engineering profession. Currently less than 1% of engineers have First Nations heritage. Youth miss out on career opportunities and communities lack needed skills among people in their own culture. In 2010, to try to remedy this situation Engineers Canada entered a partnership with the Assembly of First Nations to promote awareness of and increase access to careers in engineering. In 1996, we profiled two programs tackling a multifaceted problem in different ways. UBC initiated and continues to offer "First Nations Professional Science Access." The focus is on providing a bridging year of personalized academic study coupled with the unique cultural support of their campus Longhouse activities. At Concordia University, a joint program was developed with the Québec Order of Engineers called "Engineering Exploration Summer Camp for Aboriginal Students." It was held annually in Montreal from 1994 until 2006 with a mission to inspire budding engineers. Experience has shown that successful programs require much more than simple academic support to bridge the cultural gaps and enable success for First Nations students in what seems to many a foreign environment.

> "We as students, are here not only to brighten the future for ourselves, but also for the whole Native community"

Education / *Éducation*

AT THE DAWN OF FIRST NATIONS ENGINEERING

Order of Engineers of Québec and Concordia University combine efforts to assist First Nations breaking into engineering

by Jorge Campos
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As First Nations communities struggle to improve the quality of life in the reserves, the need for science and technical oriented people increases. Native engineers will have a prominent, if not fundamental, role in the development of their communities. Yet, due to social and historical factors, an effective First Nations engineering work force is mostly a dream which is overdue to bloom into reality. Sensitive to a new spirit amongst native leaders, the Order of Engineers of Québec and Concordia University initiated serious efforts to promote native access to engineering.

À l'heure où les autochtones se démènent pour améliorer la qualité de vie dans les réserves, leurs besoins, en ce qui concerne la science et la technologie, s'accroient. Les ingénieurs autochtones auront un rôle déterminant, voire même fondamental, dans le développement de leurs communautés. Jusqu'à présent, à cause de facteurs sociaux et historiques, former un groupe de travail d'ingénieurs compétents à l'intérieur des communautés autochtones était un rêve, mais qui est en voie de devenir réalité. Sensible à ce nouvel état d'esprit parmi les leaders autochtones, l'Ordre des Ingénieurs du Québec en collaboration avec l'Université Concordia ont initié un effort sérieux afin de promouvoir l'accès à l'ingénierie pour les communautés.

The predisposition to move towards brighter horizons is nowhere so evident as in the First Nations leaders' determination to direct their youth to higher studies in science and engineering. With lawyers successfully settling more and more land claims, the need for technical people to develop the native administrated territories becomes a pressing priority. Municipal infrastructures, bridges and roads, health services, natural resources optimization and geographic management are just some of the fields requiring immediate attention.

The new commitment has not gone unnoticed. It has enjoyed substantial coverage in the Canadian press, even occasionally making front page headlines. Many universities and the provincial engineering associations did not ignore it either. Recent articles in Plan and in Engineering Dimensions, respectively the publications of the Order of Engineers of Québec (OEQ) and of the Association of Professional Engineers of Ontario, have shed light into the difficulties experienced by natives in their struggle for technical emancipation.

Faced with a promising situation which seems to linger, the OEQ and Concordia University took in late 1993 a rather bold step. They combined efforts to create the Joint Working Force on Native Access to Engineering. The OEQ counted with a strong knowledge on minority issues, accumulated from such programs as Women in Engineering. On the other hand, Concordia University has for years welcomed native students. With an estimated two hundred North American aboriginal students in a population of 25,000, the university had the concern to assure the services of some native teachers. Since 1992, it also runs a Native Student Center. The center acts as a relay for information and experience exchange, counselling and in-house tutorial clinics.

Joining the working group, the Canadian Aboriginal Science and Engineering Association (CASEA) brought a valid native perspective to the proceedings. CASEA is an association of engineers and science oriented aboriginals dedicated to leadership training, promotion and diffusion of applied science programs among native communities. It follows on the footsteps of its powerful american counterpart, the American Indian Science and Engineering Society from Boulder, Colorado.

The mandate of the OEQ-Concordia University working group is to promote the integration of First Nations students in engineering. In a more specific way, it aims at helping create the conditions which would channel native students to engineering faculties and provide the necessary support to keep them there until they finish a degree.

The hurdles are many and not easy to overcome. They start with a lack of motivation due to the absence of role models. Just a few decades ago, Indians could not go to university. They had to give up their status and leave their communities if they wanted an university education. In Québec, in 1987, only 2.2 per cent of registered Indians held university diplomas, versus a 7.1 per cent for non-natives (more recent statistics are difficult to obtain, due to non-discriminatory laws governing surveys). From those, only a handful are engineers. It is a factor that has had a devastating effect in career choices. A study made in Kahnawake, an indian community in the outskirts of Montréal, showed that roughly 70 per cent of students coming out of a native school will go to Cegep (pre-university institutions); only 10 per cent of those graduating will move on to university.

Then, there is a certain pernicious conformism. The old ways of living and thinking are deeply entrenched. The advantages of breaking way from them are not always obvious. Many times the reward at the end of the trail does not seem worth the effort. It is not uncommon that the students are discouraged by family and friends to leave their communities. Those who persist in the ideal of higher education can find themselves labelled as giving in to the white man's pressure.

Not less devastating are the difficulties students experience once they enter university. They clash with different traditions, different perspectives on life, different needs. They find the university life intimidating, the complex bureaucracy oppressing. They have to adapt to culturally alien ways of learning and interacting. Many will be studying in a second language, and the advanced technical jargon of the classroom challenges their writing and reading skills. Frustration and despair settle in. A great number will not even complete the first year.

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Education / *Éducation*

UBC'S FIRST NATIONS PROFESSIONAL SCIENCES ACCESS PROGRAM

University of British Columbia works to encourage students of aboriginal descent to pursue careers in forestry, agriculture and engineering

by Paul Freedman (Associate Editor)
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The University of British Columbia has recently created a new program to encourage students of aboriginal descent to pursue careers in forestry, agriculture or engineering.

L'université de la Colombie-Britannique a dernièrement mis sur pied un nouveau programme destiné à promuvoir l'accès aux carrières en foresterie, agriculture et en génie pour des étudiants autochtones.

In the Winter 1995 (no. 21) issue of the IEEE Canadian Review, Jorge Campos described an initiative sponsored by Québec's Ordre des ingénieurs and Concordia University to help make university education a reality for First Nations students.

The University of British Columbia in Vancouver has also been active in this area.The First Nations House of Learning was established in 1987 to make UBC and its resources more accessible to BC's First People, and to improve the University's ability to meet the needs of First Nations. Through various processes of consultation with First Nations communities, the House of Learning aims to provide a quality post-secondary education determined by the philosophies and values of First Nations.

The First Nations House of Learning is located in the First Nations Longhouse which is the hub of First Nations activities on campus. The Longhouse serves as a "home away from home" where students can study and learn in surroundings which reflect their heritage and culture; and provides a place where First Nations people can share their knowledge and cultures with each other, with the University community and with the larger society. The traditional Salish-style Longhouse structure includes a Great Hall, an elder's lounge, child care facilities, a Sacred Circle, a student and staff lounge, kitchen, a library/resource centre and administrative offices.

The House of Learning promotes a number of initiatives designed specifically for First Nations students. These include: First Nations Health Careers, Native Indian Teacher Education Program, First Nations Law Studies and Ts"kel Graduate Studies. The House of Learning is committed to assisting First Nations students achieve their academic goals in all areas of post-secondary study.

The following text describing a new program to encourage students of aboriginal descent to pursue careers in forestry, agriculture or engineering, is taken from an article written by Shannon Horne and Treena Derrick, two students in that program, which appeared in the Winter 1995 issue of the UBC's alumni magazine, "The Chronicle".

First Nations Professional Sciences Access (FNPSA) is a five year program for students of aboriginal descent who wish to complete a bachelor's degree in forestry, agriculture or engineering. The goals are to instill in the students the skills necessary to fulfill university entrance requirements and provide a transition into each student's chosen faculty. Not only does the program provide academic upgrading, but it also acquaints each student with First Nations culture, history and ideals. Orignally, there were twenty-five students carefully selected to take part in the FNPSA. There are now sixteen, including one who has begun studies with the Faculty of Forestry. The coordinator of FNPSA, Cliff Grant, is dedicated to ensuring the success of his students.The program is funded by the B.C. Ministry of Skills, Training and Labour, B.C. Hydro, and various other organisations concerned with the advancement of aboriginal students.

The inaugural year of the UBC Access Program began with a four-week orientation in July and August, 1995. It familiarized students with their mentors and instructors, the UBC campus, and the city of Vancouver. The instructors assessed the educational background of each student, tested the students' knowledge, and prescribed personalized programs of study for the Access year.

Two months into the Access year, students were occupied with courses such as mathematics, chemistry, biology, physics, english, computer science, and First Nations studies; these will enable them to fulfill entrance requirements for the faculty of their choice. Many students are significantly challenged by their new academic lifestyle. In the midst of this challenge, students are still enjoying the opportunity that they have been given to enrich their minds and lives. They find many occasions to reflect on what this program has come to mean to them and their goals and aspirations. According to Gerald Nyce, a future forestry student, "I find this program to be a very challenging experience. All theses courses make for a very interesting life on campus, as well as in the Longhouse." Future chemical engineer, Treena Derrick, comments, "I like that I'm getting a full dose of academics, not only in a university setting, but also in a First Nations setting. It is great to be able to learn amongst some of the future leaders in the First Nations communities."

Six months later, students began their four year bachelor's degree programs, in September 1996. Students feel assured that the preparatory year will prepare them for the rigours they will face in the coming years and are confident that they will be capable of achieving their academic goals. In the minds of many students is the awareness that they are only at the beginning of a journey. In the words of Shannon Horne, future agriculturalist, "We, as students, are here not only to brighten the future for ourselves, but also for the whole Native community."

Power /Electrotechnique

Geomagnetically induced currents: - Causes, Effect, and Mitigation

by Tom Molinski - Manitoba-Hydro

Geomagnetically induced currents (GIC's) that can flow in power systems are caused by geomagnetic storms. Geomagnetic storms are originated by solar flares from the sun. The GIC's and the corresponding harmonic currents may cause detrimental effects to power systems such as equipment damage (eg. to transformers, generators, capacitor banks), improper relay operation, and even system shut down. This article summarizes various research efforts studying the cause, effect and mitigation of GIC's in power systems.

Les orages géo-magnétiques induisent des courants dans les réseaux électriques qui peuvent perturber leur fonctionement . Non seulement peuvent-ils endommager les équipements tels que transformateurs, génératrices et bancs de condensateurs, causer un déclenchement intempestif des relais de protection, mais aussi entrainer à la limite, une panne de réseau. Cet article résume les recherches en cours sur les causes des courants géo-magnétiques, leurs effets sur les réseaux et les moyens de mitigation envisagés.

Geomagnetically induced currents (GIC's) have been known to occur in power systems for more than 50 years, and were considered harmless. However, in the last 25 years it was realized that large GIC's can flow in power systems and become problematic. Utilities susceptible to GIC do not want to rely on luck, that the geomagnetic storm will not affect them, or if it does, the loading conditions at the time will allow enough margin to ride through it. This is precisely why utilities today are studying the cause, effect and mitigation of GIC's.

It is because of the excellent co-operation of the scientific community involved in this research that we have the understanding that we have today; and it is necessary to continue this co-operation for a more thorough understanding of these immensely complex phenomena. Several institutions (Canadian Electrical Association (CEA) in Canada, and Electrical Power Research Institute (EPRI) in USA, among many others) are actively involved in this research.

The effect of GIC's on electric utilities has been the topic of research and discussion for many years. However, it was the "great storm" of March 13, 1989, causing a blackout of the entire Hydro-Quebec system, that prompted utilities to realize that a better understanding of GIC's was necessary.

CAUSE OF GIC's

Geomagnetic storms are the root cause of GIC's, which flow into the grounded neutral points of power systems. The source of geomagnetic storms is the Sun, which is 150 million kilometres (93 million miles) away from the earth. Some understanding of the physics involved will assist the reader to appreciate how difficult it is to predict geomagnetic storms and why today's predictions are only about 15-30 percent accurate. This makes it difficult for utilities to take precautionary measures (usually costly) when many alerts are false alarms. It is noteworthy that five or six utilities do take some action on this basis, typically reducing line or transformer loadings.

More frequent and more intense geomagnetic storms occur when sun spots, which are dark areas on the surface of the sun, cause large ejections of charged particles (solar flares) or coronal mass ejections from the sun's outer atmosphere (corona). Charged particles are always flowing from the sun toward the earth, creating what is called the solar wind. During solar flares, the stream of charged particles that flows towards the earth significantly adds to the existing ambient solar wind. These charged particles are mostly made up of hydrogen ions, helium ions, and electrons.

Sun spot activity and thus geomagnetic storms are cyclic, with peaks (intensity and frequency of occurrence) transpiring about every 11 years. The eleven-year cycle is thought to relate to reversal of the main magnetic (dipole) field polarity of the sun. Should a geomagnetic storm occur then there will likely be anotherone 27 days later when the solar flare is again in line with the earth (the sun makes a complete rotation on its axis every 27 days). The last peak period of geomagnetic storm activity occurred between 1989 and 1992. We are presently in a solar minimum and anticipate another peak around the year 2000. It has been observed that there is a three-year time lag from the peak sun spot activity to the peak geomagnetic storm activity. The current thinking is that certain large activities on the sun are only visible by X-ray imaging and these activities are causing geomagnetic storm peaks after the telescopically visible sun spots disappear.

There are presently two theories that rationalize the occurrence of solar flares. The first and most widely accepted is that the sun's corona, made up of a hot shroud of gases, is usually enslaved by the sun's magnetic field. At times the field weakens allowing some of these gases to escape. The second theory is that the sun's magnetic field is disrupted and actually catapults these gases outward. Both these theories suggest changes that are occurring to the sun's magnetic fields, for which the reasons are unknown at this time.

The solar wind travels towards the earth at a speed of 500-1000 kilometres (300-600 miles) per second, taking 2-3 days to reach the earth's own magnetic field, called the magnetosphere. The solar wind also has a magnetic field associated with it. It is the orientation of the solar wind's magnetic field that determines whether or not a geomagnetic storm will occur. It should be noted that the orientation of the vertical component solar wind's magnetic field can be either northward or southward. The earth's magnetic field is oriented from south to north and tends to prevent the solar wind from entering the earth's magnetosphere. However, if the magnetic field of the solar wind is oriented from north to south (opposite to the earth's magnetic field) then the field lines of the solar wind and the magnetosphere "reconnect" [1], allowing the solar wind to enter the earth's magnetosphere, giving a possibility of a geomagnetic storm.

This effect may be compared with the attraction of magnets of opposite polarity while magnets of the same polarity repel each other.