Vol. 8, No. 1
The Engineering Explorations Newsletter
Harmonics

What is a geomatics engineer?

Have you ever walked with your grandparents through the place where they grew up? What stories do they tell you while you travel past familiar landmarks?

We all carry maps of familiar places in our heads. These mental maps show us the places we know with all their constructed (roads, buildings, parks) and natural (plants, rocks and water) features. But the information they contain goes way beyond the layout and topography of a place. Mental maps also carry stories and images of the people and events we have experienced in these places. By layering information on top of the physical layout of a place, our mental maps have provided us with an extremely efficient and useful way to store and recall information. This is how we know where to get the best pizza in town (and when the pizzeria is open), or the location of the small sheltered inlet that the geese use as a rest stop during goose break. The maps in our heads have always been much richer than any map purchased at a gas station – until recently.

As computer processing power and access to geographic imagery and data from satellites has increased, electronic means of layering information has allowed us to begin producing maps much more like the ones we carry in our heads. This gathering, analysis and use of this information is the work of geomatics engineers.

Geomatics is a combination of geography - the study of the earth's physical features and life - and informatics – the storing, manipulation, analysis and visualization of information using computer systems. Geomatics engineers combine geomatics with surveying, mapping, navigation, GIS (Geographical Information Systems) and GPS (Global Positioning Systems) to conduct many activities including environmental studies, land management, infrastructure development and natural resource evaluation.

Because geomatics allows for the combination of information regarding the land, its history and its use, it has the potential to let us see our past and present and to plan for the future. For instance:

- By taking satellite images and talking to Elders, geomatics engineers can produce maps that show traditional territory and its use. This information can then be used to negotiate land claims.
- By placing air and water temperature observations. along with the dates of ice break up and bird migration on maps of the north, geomatics engineers can develop evidence of climate and environmental change. This information can then be used to focus international attention on the problem of global warming.
- By using satellite tracking collars on caribou, geomatics engineers can map the habitat, home range and movement of herds. This information can then be used to make decisions about land use so that it does not negatively impact the herds.

These are just a few examples of how a geomatics engineer could contribute to Aboriginal communities. Imagine what you could do as a geomatics engineer.

Sources: Geomatics Canada, http://ess.nrcan.gc.ca/geocan/index_e.php; SAIT, http://www.sait.ca/calendars/daycalendar/courses/agnt.htm; University of Calgary, http://www.geomatics.ucalgary.ca/whatisit/index.html, York University, http://www.eng.yorku.ca/geomatics/

Native Engineers & Scientists

A place to meet people from your community.

Name: Kenneth Paul
Nation: Maliseet First Nation at Tobique, New Brunswick (Wolastokiyik Neqotkuk)
School (s) Attended: Dalhousie University & University of New Brunswick, Currently pursuing a Master's degree in Engineering (Geomatics)
Degree (s): Bachelor of Science in Mathematics
Job Title: Senior Policy Advisor, Aboriginal Initiatives (Parks Canada)
Favorite thing about job: "Working with elders and community members."

When Kenneth Paul was in high school he thought of becoming a dentist. Now a Senior Policy Advisor for Parks Canada's Aboriginal Initiatives division, he's a long way from standing over a dentist's chair. Kenneth works with people from Aboriginal communities and National Parks and Historic Sites to create programs that are related to the environment, culture, policies and employment in Canada's Atlantic region, "This is one of the ways I contribute to the healing of Mother Earth."

In school, Kenneth enjoyed math and science, but he really didn't know about the wide range of jobs available in those fields. He has discovered them since graduation. Before Parks Canada, Kenneth was with the Canadian Hydrographic Service. He was in charge of doing field surveys on land as well as at sea. While there he helped to develop an ocean mapping project with the Eskasoni Fish and Wildlife Commission (EF &WC). He had heard that EF & WC had a traditional knowledge mapping project and wanted to get involved to establish a mapping program that helped the community monitor water quality. "The best science comes out when both traditional methods and western science are used to address a problem."

Kenneth continues to work while he finishes his Masters degree and is a wonderful dad of two beautiful children, Naomi (6) and Oscar (6). He says that although school can be stressful, it is rewarding when an assignment gets done or when he meets interesting people. When he's not working or in school, Kenneth plays guitar and percussion. He states that, music allows him to experience different cultures and gives him a deeper appreciation of his own Wolastokiyik heritage.

"I have learned from many traditional people and Elders about the contributions that Native people have made and continue to make to our society," Kenneth says. "If Native people work in the fields of engineering and science, then the interests and priorities of Native communities will have a much better chance of being addressed."

For more information about the project in which Kenneth was involved visit the Eskasoni Fish and Wildlife Commission online, http://www.tec.ednet.ns.ca/wildlife/.

Sea Ice

For as long as the people of the north can recall, the ice has been a predictable part of their lives. On the land, and on the seas, the ice has ebbed and flowed with the seasons, but has never completely disappeared. The migration of the ice, is echoed by migrations of Arctic animals like polar bears, bowhead whales, and caribou. The environment is fragile, but it has supported the animals and people for many, many generations. Now, however, there are changes taking place. Whether through natural processes of the planet, human impacts or a combination of the two, the Arctic (and Antarctic) is warming. Animal migration patterns are changing, southern animals are extending their ranges farther north and the ice is not as predictable as it once was.

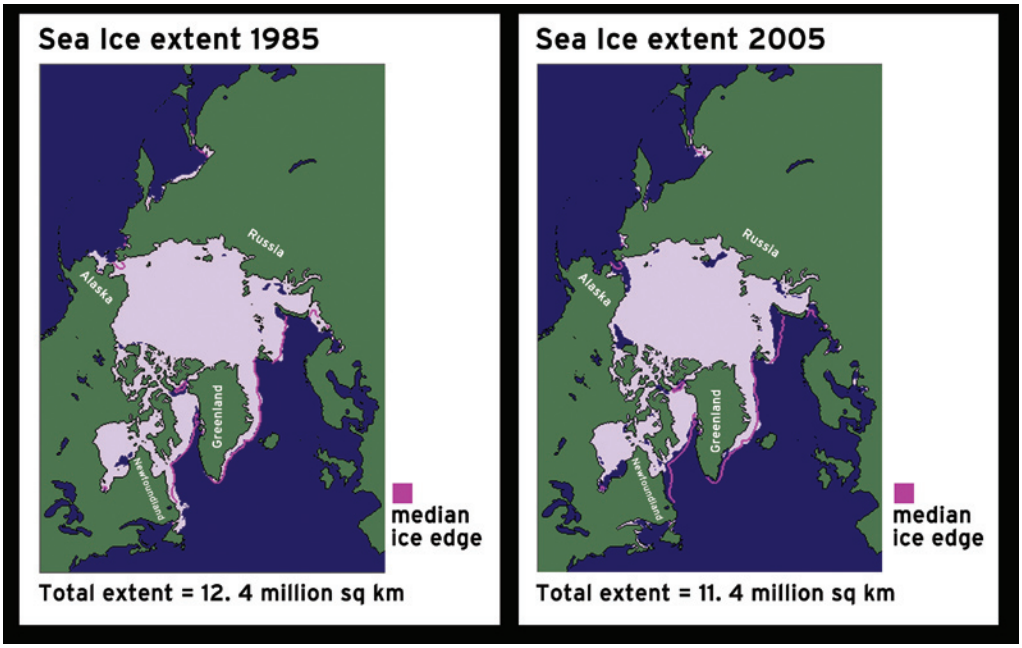
The Inuit have been documenting changes in their environment for a number of years. Their observations, coupled with those gathered by scientists from around the world, are providing compelling evidence in support of global warming. One of the key changes being observed is the amount of sea ice present in northern oceans in the summer.

Sea ice is frozen salt water which floats on the surface of the ocean. While the Inuit track differences in sea ice coverage through reports by hunters and fishermen, scientists track the differences through satellite imaging. Most satellite images of the northern (and southern) regions of the globe are captured through radar and passive microwave imaging. Passive microwaves are an advantage in the north because they can "see through" cloud cover to the land and water below. To a satellite using passive microwave imaging, sea ice and sea water look very different. Scientists use the images produced by passive microwaves to measure ice coverage, thickness etc. and compare how the measurements have changed over a number of years.

The images below show sea ice coverage in the Arctic in June 1985 and 2005. While the images are similar at first glance, there has been a reduction in sea ice coverage of a million square kilometers. Can you see the changes? Compare 1985 to 2005 in the following places:

- southern extent of sea ice down the east coast of Newfoundland, Greenland and Russia
- amount of open water in James Bay and Hudson's Bay
- amount of open water off the northwest coast of Alaska
- general ice coverage over polar waters.

Sources: Scientists sound alarm on Arctic ice cap, http://www.cbc.ca/story/science/national/2005/07/29/Arctic-ice050729.html: NSIDC, http://nsidc.org/data/seaice_index/derivation.html



Source: Based on images from the National Snow and Ice Data Centre, Sea Ice Index, http://nsidc.org/data/seaice_index/archives/image_select.html

Community Profile

Kainaiwa Nation, Alberta

The Kainaiwa (or Blood) Nation is located in southwestern Alberta, about 200 kilometers south of Calgary, near Lethbridge. Historically, the people were allied with the Siksika (Blackfoot), and Piikan (North and South Peigans) to form the Blackfoot Confederacy. Today, they are a part of Treaty 7 which includes their Confederacy partners as well as the Stoney and Tsuu T'ina Nations.

Most of the 9000+ members of the Kainaiwa Nation live in one of 7 communities on the Blood Indian reserve. Over the past decade or so, they have taken control of their own territory and administration. The reserve is big, covering more than 1600 square kilometers, so mapping the land, its features and uses (past, present and future), is very important.

In 2000, the Kainaiwa Nation took part in a Natural Resources Canada project called the Sustainable Communities Initiative (SCI). SCI helped communities to develop expertise in Geographic Information Systems (GIS) that could be applied to decisions about their economic, environmental and social development. The Kainai used the programme to train people who have since taken on a number of projects on the reserve.

One of the first projects was the design of an enhanced emergency response system. With about 160 kilometers of primary roads and 800 kilometers of secondary roads, emergency crews for fire and ambulance services did not always know the best and fastest routes to every location on the reserve. Using GPS technology and satellite maps, the location of every home and business on the reserve was accurately entered into a computer system that can map routes for emergency crews. This system also allowed the community to tie into the 9-1-1 network for southern Alberta.

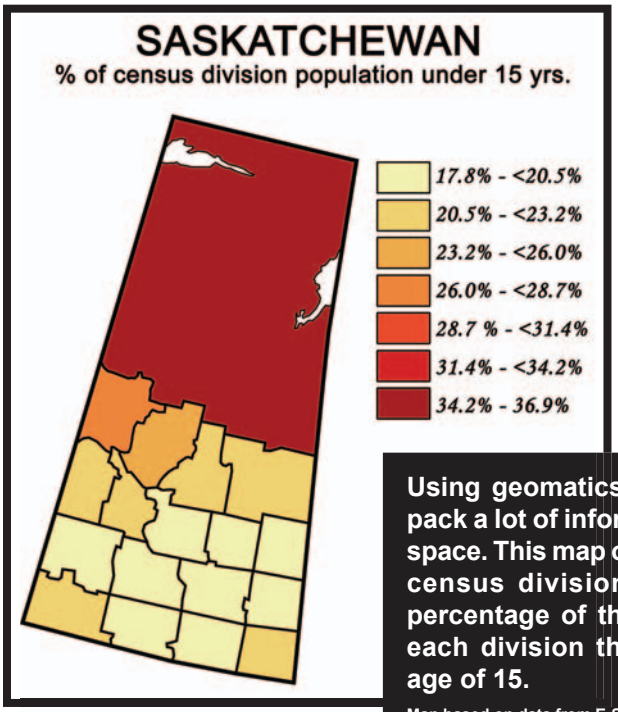
GIS has also been used to identify land use (both traditional and non-traditional), mineral deposits, and potential oil and gas exploration sites. This information will help the community make decisions about future land management. In fact, it already has: when the information provided by the GIS system let Chief and Council see that a proposed oil site was right next to a burial ground and medicine wheel, they took the decision that no development could be made next to historical or sacred sites.

Sources:
Bloodtribe
http://www.bloodtribe.org/main.html
Treaty 7 Management Corporation
http://www.treaty7.org/Article.asp?ArticleID=35
SCI
http://sci.nrcan.gc.ca/index_e.php
SCI – Success Stories: Blood Tribe, Alberta
http://sci.nrcan.gc.ca/success/blood_e.php

Fun facts and things to think about

Light at night
This image from NASA's Visible Earth project, was created by compiling night time satellite images of the Earth's surface. While it may seem like just a map of lights, it actually provides us with a lot of information. For instance,
• The brightest areas of the Earth are the most urbanized, but not necessarily the most populated.
• Cities tend to grow along coastlines and transportation networks, so even without the underlying map, the outlines of many continents would still be visible.

In larger versions of this image, it is possible to pick specific communities in northern Canada, just by the position of the lights. To access a larger image, go to NASA, Visible Earth, http://visibleearth.nasa.gov/view_rec.php?vev1id=5826.



Using geomatics tools, you can pack a lot of information in a little space. This map of Saskatchewan census divisions, shows the percentage of the population in each division that is under the age of 15.

Map based on data from E-Stat, http://www.statcan.ca

Did you know ...
people have been making maps for thousands of years? The earliest maps were made on readily available materials which varied depending on location. For instance,
• The Mesopotamians (around modern day Iraq) used clay tablets.
• The Polynesians (in the south Pacific) used reed maps.
• The Inuit used driftwood and bone.

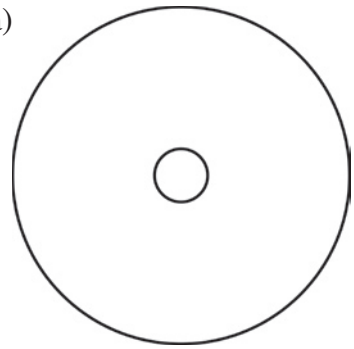
I may not have gone where I intended to go,
but I think I have ended up where I intended to be.
- Douglas Adams

Puzzles & games

Colours and maps

Mapmakers, also known as cartographers, have rules for making maps. One of the key rules is that any two regions on a map that share a border must be different colours. (A point is not a border.) It has been proven that you never need more than 4 colours to complete any map. What is the least number of colours you need to colour in each of the following maps?

a)



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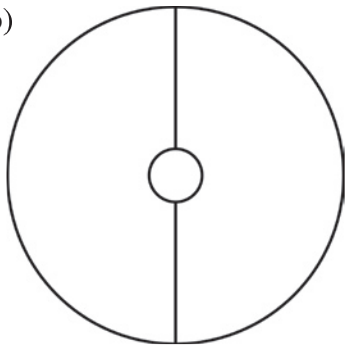
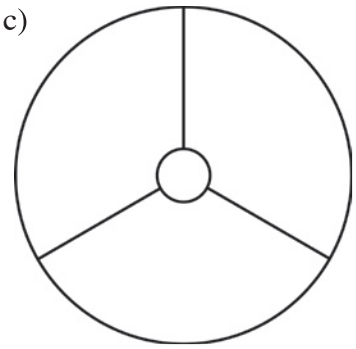
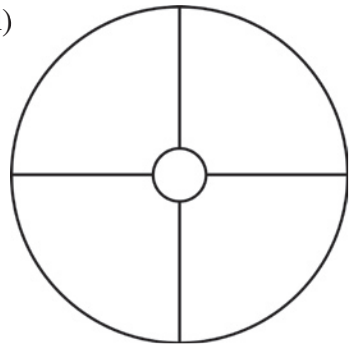


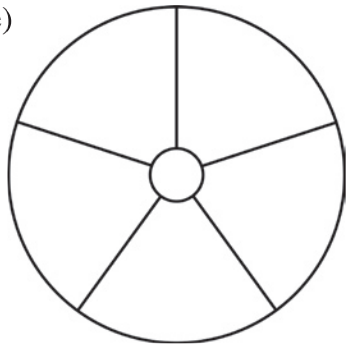
c)



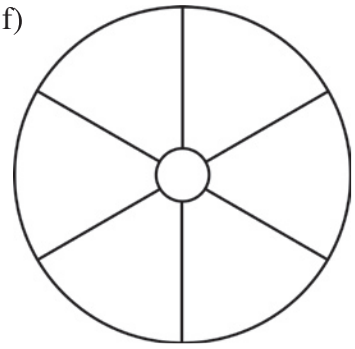
d)



e)



f)



Answer: a-2; b-3; c-4; d-3; e-4; f-3

All about us

Native Access provides culturally relevant learning opportunities in science, math, engineering and technology to Aboriginal students and their teachers across Canada.

Established in 1993, the projects ultimate goal was to increase the representation of Aboriginal peoples among the the ranks of practicing engineers and scientists in Canada.

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