HARMONICS

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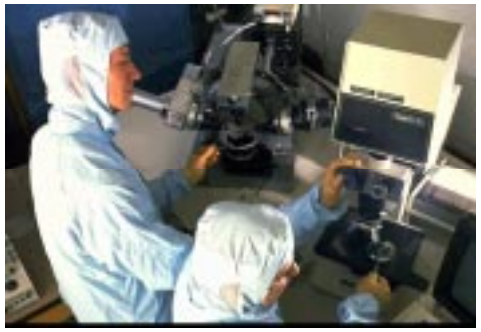
WHY IS MEASUREMENT IMPORTANT IN ENGINEERING?

When you get out of bed in the morning you probably don't think that you're going to be measuring things all day, and yet it is activity which we all do quite often without even realizing. We do it when we are cooking, counting, getting gas or just sitting the classroom waiting for class to end. More formal measurements are an important part of the work of many people including doctors, butchers, airline pilots, chefs and even artists. Measurement plays a very important role in engineering research, design and development. Length, pressure, weight, velocity, temperature and electrical charge are just a few of the things which engineers routinely measure in their work, and they measure these things very carefully because in many ways, engineering is a profession based on accuracy and precision.



Measurement is important to all engineers because it helps them evaluate efficiency, durability and performance. It is also part of how they communicate with each other. Certain types of engineer, however, are really in the business of measuring things. Survey engineers measure land, building plots roads and highways. Controls engineers develop devices for measuring and controlling things like temperature and humidity, and even the angle of ailerons on airplane wings. And then there are safety engineers.

Safety engineers are people who break, explode, run over, smash, burn, freeze, corrode and otherwise try to damage the products that are sent to them for testing. By taking very careful measurements from these tests, they are able to tell other engineers just how much abuse the products they develop are able to withstand before they breakdown and become potentially hazardous to people. They test things as diverse as children's pyjamas and bullet proof glass. (Yes, they do actually shoot at it to see if it breaks!) By conducting these tests safety engineers are able to guarantee product performance and public security. Safety engineers also evaluate industrial processes like car manufacturing and provide advice about how to make the process safer for plant workers. Another job they do is develop emergency action plans for areas where potential hazards exist. This aspect of their work involves things such as planning chemical spill cleanup and disaster evacuation.

Within Aboriginal communities the are many opportunities for people who are professional measurers. The knowledge of control engineers is key in areas as such as water filtration, sewage treatment, energy distribution and communications. Survey engineers can provide accurate information about community lands, help in the development of infrastructure and contribute to land claim negotiations. Safety engineers could contribute to communities in a number of ways by measuring air quality in buildings, by developing safety protocols for infrastructure construction and other major work and by working with the band council to establish plans to ensure the safety of community members in case of natural disaster.

NATIVE ENGINEERS & SCIENTISTS

A place to meet people from your community.

Marsha Wysote: Biologist

Marsha Wysote believes in the work she is doing. For the past two summers, the 21 year-old Micmac from Blanc Sablon, Quebec has been diligently studying ocean algae.

Working in Montreal under the supervision of her McGill University professor, she has been busy in the lab measuring phytoplankton (algae) growth in media of varying trace metal concentration. Marsha explains, "Very simply, we artificially recreate samples of ocean water which we previously analyzed. Then, we add or take away trace metals to see how it affects the algae's growth." Looking at trace metals in plant life is important because high levels can be toxic. Careful measurement plays a vital role in the study.

"We start with 20 litres of sea water that was created using a recipe which mimics natural ocean water. If we are studying the effect of cadmium (a metallic element) on algae, we make several batches of synthetic ocean water with varying amounts of cadmium. By observing the growth rate of the algae, we'd be able to tell the effects of varying degrees of cadmium."

In the bigger picture, cadmium can leak into water from pipes and solder or may enter water from chemical waste disposal sites. Marsha adds,

"The whole reason these studies are important is because algae is at the low end of the food chain and all water life depends on it as a food source. Algae is the food source for zooplankton (tiny aquatic animals), which in turn is the food source for fish, and way at the other end of the food chain are mammals, including humans, who eat the fish."

Contamination in the food chain affects the quality and safety of the foods we eat. If contaminants build up in a body (animal or human) over time, they have the potential to have severe health effects including cancer, birth defects and diseases of the central nervous system.

Marsha is entering her 3rd year at McGill University and is working towards a Bachelor's degree in Science, majoring in Biology. She is considering graduating with a minor in Neuroscience. She chose Biology because "Biology is a general field that has a broad scale. It is a good basis to do further studies." Her interest in science was sparked by a great teacher in CEGEP; "Her enthusiasm was contagious and I got hooked."

Marsha aspires to do research in neuroscience because it is devoted to the understanding of the nervous system. As well as studying the brain at many levels, neuroscientists investigate the functioning of the nervous system of many different animals, from simple invertebrates, such as jellyfish, to humans. She firmly believes that the work she is doing is beneficial for society. She explains, "Algae is so crucial to the survival of other life forms. Most of what I learned in marine biology is global and can be applied to any water system in the world."

This interview was supplemented by information found at http://www.atsdr.cdc.gov/ToxProfiles/phs8808.html and http://www.total.net/~niichro/intouch/environ/environ2.htm.

Dear Dr. Science,

My friend thinks that the Maya had a calendar that was only 260 days long and I say that they had a calendar that was 365 days, just like ours. Can you help settle this disagreement?

Daisy D. & Confucius D.,
Waskaganish, QC

Each Mayan month was represented by a glyph like the ones pictured here.

Dear D & C,

Well, you are both right. The Maya had a 365-day calendar that had 19 months. It was known as the "haab". The first 18 months had 20 days each and the last month had 5 days. This calendar was based quite accurately on the solar year. As a matter of fact, the Mayan calculation of the solar year was a 10,000th of a day more accurate than ours is!

The Maya also had a 260-day calendar called the "tzolkin." We don't know exactly why they had such a calendar, but some theories suggest it was based on their observations of the planet Venus, and other theories say it might be based on the period from conception through birth of human babies.

Every 52 years, the 2 calendars coincided, marking an event the Mayas feared. Believing it was a time of divine judgement and that the world would come to an end, the Maya performed ritualistic sacrifices to pacify the gods during these years.

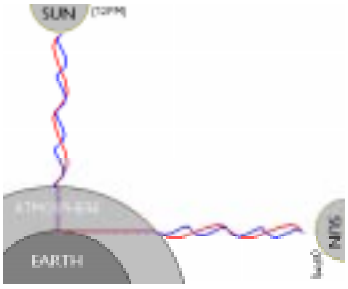
The Maya, who were mainly farmers, were concerned with the changing of the seasons. It was out of this concern that Mayan spiritual leaders began observing the celestial patterns in relation to the seasons. This became a way of calculating the best time for planting.

Archaeologists believe the Maya also used the calendar to keep track of important actions performed by their leaders. Mayan priests were responsible for keeping track of the passage of time, and specifying when certain rituals would take place. Often, these rituals were reenactments of the original event which were held on its anniversary.

Dr. Science

The information in this article is based on an on-line exhibit at the Canadian Museum of Civilization http://www.civilization.ca/membrs/civiliz/maya/mmc06eng.html#calendar.

Red Sky - Blue Sky



Source www.arachnoid.com/index.html

Looking west, at the evening sky
I stand out on my porch
And watch the sun set
Lighting heaven like a torch

It burns like fire with shades of pink
different from the daytime hue
and I wonder to myself
How does it change to red from blue?

My favourite teacher, I recall,
presented me with facts
about the way light travels
to us both in waves and packs.

Little packs of bright rainbow pieces
made from the colors of light
red and green and yellow and blue
collectively known as "white"

Light gets refracted -split apart -
by prisms made of glass
an experiment we've all tried
in grade 9 science class

The atmosphere around the Earth
Produces a like result
It splits the light, in special ways,
And lets different colours out.

At high noon, we see blue sky -
And this will sound quite strange -
Because the air reflects the blue
Its wave lengths out of range.

At 6pm, all the light
that journeys from the sun
travels further through our air
than when lunch was begun.

The bigger distance means a lot
In terms of what we view
Now blue gets through, but red does not
And the sky's a different hue.

The moral to this short, short tale
is in the range of light
Red's wavelengths are longest
So we see them near to night.

And know you know the reason why
when looking at our star
we see those amazing reds
when light has traveled far.

The Sweatlodge: Measurement in Time and Space


Source:http://www.rescol.ca/collections/luxton/sect_4/4cl3.htm

Imagine yourself sitting quietly atop cedar boughs in a dark, circular, steaming hot hut,. You are inside the moist womb of Mother Earth and you are not alone. Others are seated around the perimeter of the circle with you. Everyone is using the rising steam from heated rocks to ceremonially purify and heal themselves.
This small hut is better known as a "sweatlodge". Entering a sweatlodge is a spiritual journey, but it is also a journey of time and space.

For Native peoples of Canada and the United States, the sweatlodge represents the womb of Mother Earth through which they can be ceremonially reborn. Within its walls people find a deep reconnection to the past which allows them to form a bond with the Creator and all of creation. Elders have said that while in a sweatlodge, it is possible to travel faster than the speed of light. They explain that if a person was racing against the light, it would move only one inch in the time it would take the person to get to the moon and back.

How does one formally measure a journey in time and space where the human spirit is transported to distant dimensions? It can be mind-boggling to comprehend. An old man once described the experience of the sweatlodge as becoming like a child again, "*for the child lies on its back and only takes the thoughts, the sights, and the sounds of the moment.*"

The sweatlodge is also an amazing example of math made real. Look at its physical structure and think about its shape in relation to things you know from your math class: diameter, radius, circumference, congruency, symmetry, and three-dimensional geometric solids. It certainly is amazing to consider the mathematics contained in one little domed structure.

The information contained in this article was obtained from *Mother Earth Spirituality* by Ed McGaa (Eagle Man). New York: Harper Collins Publishers, 1990).

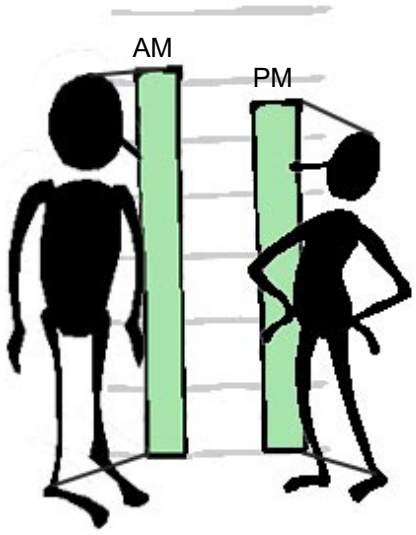
FUN FACTS AND THINGS TO THINK ABOUT

All in a day's work

- **A day is a measure of how long it takes a planet to make one full rotation around its axis.**
- **One day on Earth is 23 hours, 56 minutes and 4.091 seconds.**
- **Other planets have different lengths of day:**
  Mercury: 59 days
  Venus: 243 days
  Mars: 24 hours, 37 minutes, 23 seconds
  Jupiter: 9 hours, 55 minutes
- **We measure a day beginning at midnight. The Ancient Babylonians measured the day from sunrise and the ancient Jews measured it from sunset.**

Source: World Book On-line
http://www.worldbook.com/fun/calendars/html/measuring

Source: NASA
http://www.nasa.gov



Did you know ...

... you're taller in the morning than you are at night? During the night your spine stretches to its full length so when you get up in the morning you're at your tallest. During the day gravity acts to compress your spine, so you get shorter as the day progresses. An average adult shrinks by 16 millimeters between getting up and going to bed.

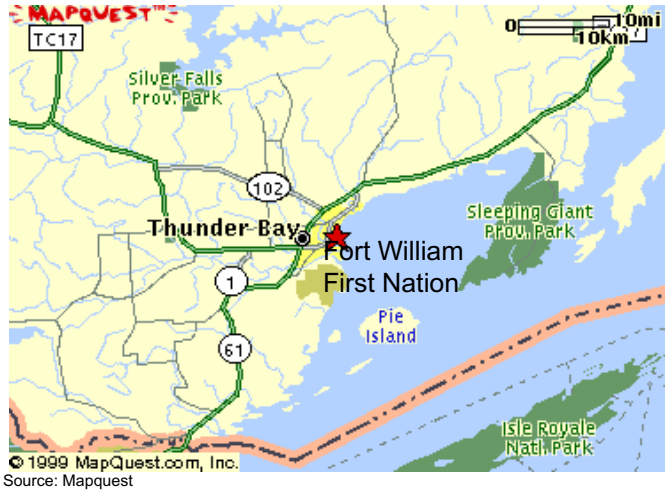
The ultimate measure of a man is not where he stands in moments of comfort, but where he stands at times of challenge and controversy.

- Martin Luther King, Jr.

COMMUNITY PROFILE

Fort William First Nation

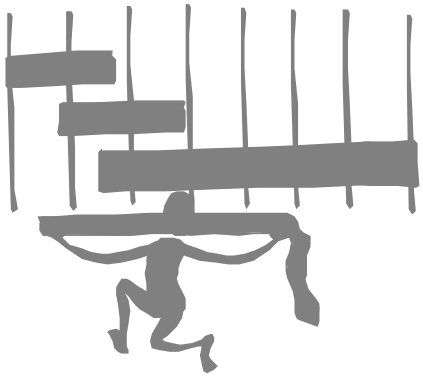
Land claims, the future and measurement



Source: Mapquest
http://mapsonline.com

The Ojibwa of Fort William First Nation live at the head of Lake Superior, near Thunder Bay, Ontario. They know first hand the importance of accuracy when dealing with measurement. Units, such as the league or the mile were foreign to the Ojibwa before contact with Europeans was established. The Ojibwa had their own terms for measuring distances based on the time it took to get from one place to another. This was a unique way to measure things which took into account whether travel was by water or land, the difficulty of the terrain and the weather.

The first Europeans the Ojibwa came into contact with were the French. It was the French who introduced them to measurement using '*leagues*'. (A league is about 3 miles or just under 5 kilometers.) The Ojibwa did not completely understand the term and, in fact, the Ojibwa word for 'league' originally meant 'a measure used by the French'. In time, it came to mean just 'measure'. The word for 'measure' was not limited to distances however. It could also be used to describe weight or volume.



This imprecise use of the terms caused confusion when the Ojibwa negotiated with the British for reserve land. By this point in time, the Ojibwa unit was the league, which they had learned from the French. The British, however, used the mile as their unit of measurement for distance. It was a misunderstanding of which units were being used to measure the land that created a problem which is still unresolved today. Under current land claims, the Ojibwa of Fort William First Nation are arguing that the British used the mile where they should have used the league, and that the reserve is actually 3 times smaller than it should be.

The information in this article was found in the *Report on the Leagues and Miles Claim of the Fort William First Nation*.

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 projectÕs ultimate goal was to increase the representation ofAboriginal peoples among the the ranks of practicing engineers and scientists in Canada.

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