What is Materials Engineering?

Why do we put hot coffee in ceramic or styrofoam cups instead of metal ones?
Why is it more comfortable to wear a fibreglass cast on a broken arm than a plaster cast?
Why are pick up trucks made out of aluminum, steel and plastics instead of stone?
Why do some artists use oil paints and others acrylics?

Well, the easy answer is that some materials are just better suited to one purpose than another. Ceramic and styrofoam insulate our hands from the heat of boiling water better than metal; fibreglass is much lighter than plaster; aluminum, steel and plastics are more versatile and moldable than stone; and, oil paints remain wet and workable longer than acrylics. The material you use for a particular job really depends on what you’re trying to do.

Materials engineering is all about knowing what materials to use for a job. It’s also about studying the properties of materials, developing new materials and finding new ways to work with existing materials. Engineers who specialise in materials work in many different fields. Some work in the petrochemical industry because many modern materials, such as synthetic rubbers and plastics, are made from the by-products of petroleum refining. Others work in the automotive and aerospace industries. Engineers in these fields are really interested in harnessing the heat resistant properties of ceramics for use in engines. Still other engineers might study all the materials related to housing - insulation, bricks, wood, cement etc. - or to clothing manufacture.

Aboriginal peoples have been materials engineers for generations and generations, using and transforming materials from the natural environment for day-to-day needs.
- Animal hides are tanned or otherwise treated then sewn for use as footwear, pouches, clothing and shelter.
- Bone, stone, shell, antler and ivory are or have been used for a number of purposes including beads, fleshers, hammers, weapons, scrapers, currency and musical instruments.
- Timber and wood also have many applications: housing, instruments, fire drills, snow shoes, canoes etc.

In some places even what is found on the ground can be used. The Inuit have used the insulating properties of ice to built igloos for centuries. And, in the southwestern United States, adobe soil which contains a very fine mixture of clay, quartz, and other minerals, can be used to build very durable bricks. Adobe can be molded easily when moist, but is incredibly hard and durable when dry; some adobe structures have been standing for about 100 years.

Today, Aboriginal people continue their culture of materials engineering by maintaining traditional practices and by adopting new materials for traditional designs. Perhaps nowhere is this more evident than in canoes and kayaks; their design has remained the same for more than 1000 years, but now they are usually made from kevlar (the stuff of bulletproof vests), aluminum, plastic or fibreglass instead of wood, resin and bark.
Native Engineers
A place to meet engineers from your community.

Artist and Engineer: Bill Reid

“The Raven was significant to Reid, not only as a cultural hero of Haida mythology..., but also for the ability to transform inanimate material into dynamic forms...”

Artists and engineers have more in common than most people might think; both work with and transform materials to make their visions come to life. Where engineers use metal to build a bridge, artists use it to cast a statue; where engineers use ceramics to provide heat resistance to the Space Shuttle, artists use it for hand crafted vases; and, where engineers use wood to build house frames, artists use it to carve totem poles. Both the engineer and the artist must have a strong and well-developed sense of the materials with which they work in order for their visions to emerge.

Bill Reid (1920-1998) is one of Canada’s best known artists. He was born in Victoria, BC in 1920 and knew very little about his Haida heritage (his mother was Haida) until he was an adult. He actually started his career as a radio broadcaster, and even worked for the CBC in Toronto for 10 years. It was there that Mr. Reid learned how to work with gold and silver for making jewellery. He was following a family tradition as his grandfather was Charles Gladstone, a Haida carver and silversmith. It was also in Toronto that Mr. Reid got his first real exposure to Northwest Coast art at the Royal Ontario Museum.

Upon returning to Vancouver in 1951, Mr. Reid’s interest and exposure to Haida art and designs deepened, and he began using Haida images in his jewellery. In 1958, he joined a project at the University of British Columbia to restore Haida wood carvings, including a number of totem poles, from a village on the islands of Haida Gwaii. By working at first with Kwakwaka’wakw master carver Mungo Martin and then through careful study of the poles he was helping to restore, Mr. Reid developed his understanding of the Haida visual language and his mastery of wood carving. He thought of wood carving as, “an exercise in peeling away the outer layers to see what comes out.” The poles he worked on still stand outside the UBC Museum of Anthropology.

As his talents developed, Mr. Reid began using other materials such as including bronze, plaster, jade, and silk in his work. By using non-traditional materials - mainly for their look, strength and quality - to depict traditional Haida figures and stories he created art that was “at once rooted in tradition yet new.” Mr. Reid supported his family by making jewellery and silk screen prints, but he is best known for his large sculptures including the wood carving Raven and First Man (UBC Museum of Anthropology), and the bronze cast The Spirit of Haida Gwaii (Canadian Embassy, Washington, DC).

Mr. Reid suffered from Parkinson’s Disease for more than 25 years before his death in 1998. The shaking and muscle tremors of the disease often made it difficult for him to work for more than 5 minutes at a time, and yet, he completed some of his greatest works in the latter part of his life. As his biography at the Canadian Museum of Civilization says, “Above all, he sought to show, by example, the importance of aspiring to high standards...”

The information in this article is largely drawn from the memorial site for Bill Reid at the Canadian Museum of Civilization, http://www.civilization.ca/cmc/reid.
That Smoky Aroma

The next time you’re at a Pow Wow and happen to be browsing at a Native arts and crafts booth, take a good look at all the moccasins, mitts, mukluks and vests. Shut your eyes, tune into your sense of smell and gently breathe in the smoky aroma of tanned moosehide as you transport yourself to the northern woods that enclose the hunting camp of Joe and Mary...

It is early winter and soft layers of snow cover the ground. Joe and his two sons are on their snowshoes, following the tracks of a moose. As they advance upon the animal, its keen sense of smell senses danger and it begins to run. Sinking into the soft snow, the moose struggles to escape, but it is too late. Joe and his sons have caught up and kill it with one quick shot of a rifle. They set to work, beginning by carefully skinning the hide from the carcass...

Hours later, Mary greets the hunting party at the camp. “Ah, a large old moose. It has a nice, thick winter hide,” she comments admiringly after Joe has handed her the rolled up hide. Mary has many days of hard work ahead of her during which time she will transform the hide of this freshly killed moose into a soft, durable, workable material.

Skill and precision are required to effectively prepare a hide for tanning. First, all the fur and flesh must be cut and scraped away from the skin leaving only true leather. Then the hide will be soaked and wrung several times to soften it. It is then stretched, beaten and dried. Finally, the hide is tanned to the desired colour over a flameless, smoking fire. For the craftsman who uses moosehide to create clothing, footwear and other items, this material is a joy to work with. It is soft, strong, and pliable - a sewing needle sinks into it as if it were a pin cushion.

So, the next time you detect the smoky aroma of tanned moosehide, pay a visit to Joe and Mary, and remember the incredible amount of knowledge, skill and hard work that went into those articles you have your eyes on.

Bring Home the Bacon, Fry it up in the...

Some materials are good for lots and lots of things, even though the people who discover them aren’t sure what these things are at first. In 1938, scientists at the DuPont Company accidentally discovered polytetrafluoroethylene (PTFE). It took them more than 10 years to find a use for it, but these days PTFE is found in most of our homes. We know it by its trade name – Teflon.

Teflon is a very versatile material. It is heat resistant - maintaining its properties even beyond 500°F – tough, flexible, and chemically inert. It won’t absorb moisture and doesn’t rust or otherwise degrade when exposed to harsh environmental conditions. Perhaps most importantly, it has a low co-efficient of friction. In other words things don’t stick to it. Knowing about its properties, can you think what some of the uses of Teflon are?

Teflon is used to coat surgical implants, lab equipment and fibre optic cables. It is used to treat fabrics so that they resist stains. Teflon has also played an important role in the space program. But, most of us know Teflon from our home kitchens where it is used as a coating on cookware, and lets us fry up bacon or cook other food without a sticky mess.
Community Profile
Waterhen Lake Reserve, Saskatchewan

Tansi! I live on the Waterhen Lake Reserve located in northwestern Saskatchewan, 40 km north of the town of Meadow Lake. Saskatchewan may be a prairie province, yet where I live is definitely not flat but surrounded by woodland - mostly poplar, spruce and pine. My reserve is set on a lake. A river runs into it. Both are called Waterhen. Our band name and that of the lake originates from the thousands of waterhens that once resided here. We have cold, long winters, mild springs and hot summers.

I am of the Woodland Cree, rather than the Swampy or Prairie Cree. My people speak the "Y" dialect among the five existing dialects in the Cree language. Approximately 30% of my reserve speak Cree fluently, most being the adults and our elders. Among the younger generations, the Cree language is known in part or not at all. English is the first language, but even now among and with our elders Cree is spoken almost all the time.

The population of Waterhen is totally Cree, except for the teachers and other employees enlisted by the Band.

Our reserve has a store, an arena, a water treatment facility, a school, a clinic, and Band and postal offices. A doctor visits the clinic weekly on Tuesdays. There are transportation services for medical visits to the nearest town or city when needed.

Our school goes from nursery to grade twelve. I would say we have exceptional teachers, many who are Native people. Some have come back to the reserve to teach their own people. We are encouraged to attend university or other post-secondary programs as soon as we graduate. The encouragement for our further education is supported by the entire community. A guidance counselor helps us with any problems we may have and a post-secondary counselor is in place for questions or information on topics about post-secondary programs, classes, funding, etc. There is a lack of Aboriginal people in math and science professions, and they seem to direct us along these lines.

Our sports program is quite good and available for those students that are interested. Our gym is open constantly for recreational use and the arena is currently under repairs.

A daycare center has recently been built near the school and is preparing to open. The Pathfinder Program, one of the few in the province, educates students through the computers, self-teaching in a pace suited to the student. The educational use of computers for the Internet and various programs is available to all students.

We also have a pow wow and drama group, conferences and meetings students can go to, as well as various other opportunities set out by our guidance counselor and teachers.

The Cree people were a nomadic hunting and gathering society, separated in bands of people that moved all over the territory. My people were among the last in the province to sign Treaty Six in 1921, and settle on the reserve we now call Waterhen. Our chief then was called Roundsky. Our form of government does not differ very much from back then. We still have a chief, presently Richard Fiddler, who works hand in hand with six councilors to oversee the different aspects of the band.

Our community members hold a variety of jobs, although the majority work in forestry, as we are situated where wood is an abundant resource. Hunting, fishing and trapping are still traditional pastimes. These are not done out of necessity, but rather because of a preference for a diet of wild meat and of course, that it is tradition. In the past, there has been a program where the older teach the younger any and every traditional skill, from scraping skins to ways to cut and smoke meat. My people are determined to see that our old ways should not pass away.

This article was written by Roberta Fiddler, a Grade 12 student from Waterhen Lake Reserve.
Fun Facts and

Did you know …

… in passenger aircraft using plastic cups for drink container instead of glass will save an average of $20,000 on aircraft fuel costs per flight?

Source: http://funtrivia.com/technology/aircraft.html

You bet! For example, materials make a huge difference in telecommunications industry.

A single 4.5 pound spool of optical fiber can carry the same amount of messages as 200 reels of copper wire that weigh over 1600 pounds! A typical fiber-optic cable made up of 100 or more such fibers can carry more than 40,000 voice channels.

These remarkable strands of glass - each thinner than a human hair, yet stronger, length for length, than steel - were designed to carry the vast amounts of data.

Source: Beyond Discovery
http://www4.nas.edu/beyond/beyonddiscovery.nsf/DocumentFrameset?OpenForm&ModernCommunications

Do or do not, there is no try.
- Yoda

Source: Yoda's Mudhole
http://ccwf.cc.utexas.edu/~yodalove/dagobah.html
The northwest region of Saskatchewan is covered in forests; all the materials needed for construction can be found in the natural environment. So, it is easy to understand why log cabin building, a tradition of the Waterhen Lake Cree, is now one of the ways in which they are pursuing economic development.

In the “old days”, a senior community member explains, houses were built this way:

First, you needed to pick a good location and a level piece of ground. You’d cut down some trees and peel off the bark. Then, you’d make a notch at the ends of the logs. The notch could be either round or “V” shaped. Then, you’d put two logs on the ground for the walls and build them up until they were about 8 feet high. The roof would go on next by putting logs across the tops of the two walls. The logs would have to fit as close together as possible. Now, to keep the cold air from seeping through the logs, the holes would be filled with muskeg. That’s how it was done.

Muskeg is a mixture of mud, grass, moss, and roots. Brown and green in color, it is usually found in boggy, poorly drained areas built up with vegetation in various stages of decay. In log construction, it was and is used much like caulking to fill in gaps so that cold air and moisture are kept outside the building.

By combining the abundant natural resources of the surrounding forest with traditional knowledge and expertise, the Waterhen Band has developed a successful log home manufacturing and construction operation. Work actually begins in the bush where trees - usually spruce or poplar - are chosen and cut. They are then hauled to the local sawmill. Here some of the trees are cut into square timber and others are milled into precise shapes such as interlocking, tongue & groove notching (so that logs will fit closely together in construction). The cut timber is then either taken to construction sites or packaged for wholesale.

In the summer of 1996, the Log Cabin Project built 3 cabins and a daycare. The cabins, complete with electricity, running water and telephones, were built for the local tourist resort on picturesque Lake Waterhen. The daycare was constructed in the community and now provides a secure, attractive, fun environment for the care of community children.

The Log Cabin Project has several benefits for the community. It creates jobs, has strong financial returns and uses local renewable resources. It addresses a direct need for on-reserve housing (Waterhen like other reserves suffers from a shortage of housing). It also has economic spin-offs to other local businesses and contributes to economic development in the long-term. And Waterhen is truly looking to the future. The business plan for the Log Cabin Project initially targets other First Nations who are experiencing housing shortages and are seeking quality, low maintenance homes. Over the time, they plan to get a foothold into growing national and international markets. Contacts who will help sell Waterhen’s log cabins in Japan, the United States and Europe have already been identified.

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 project’s ultimate goal was to increase the representation of Aboriginal peoples among the ranks of practicing engineers and scientists in Canada.

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