HARMONICS

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WHAT IS AEROSPACE ENGINEERING?

The night sky has fascinated and mesmerized people since the beginning of time. All ancient cultures have stories, legends and myths about the sun, the moon, the stars and the planets. The Ojibway say the constellations are outlines of animals who ran up into the sky on a rainbow and got stuck there when the sun came out erasing their passage back to Earth. In the Americas, evidence remains of structures built to measure the cycles of the moon and other celestial bodies. Chaco Canyon Park, a UNESCO World Heritage site in New Mexico, contains the remains of a thriving Anasazi city from more than 1000 years ago. On the canyon walls are hundreds of petroglyphs (at left), about 20 of which are thought to represent a supernova explosion in 1054!

Our fascination with the universe beyond Earth continues. Gigantic spaceships and the exploration of far off planets are the subject of best-selling books and block buster movies. When NASA sent men to the moon in 1969 a huge segment of the planet's population watched Neil Armstrong place his footprint in the lunar dust. Then in 1997 when the agency sent the remote control rover Sojourner to Mars people jammed the web trying to download photos of the red planet. All this exposure may make us feel that travel to, from and in space is no big deal, but in reality we have only just begun to explore a tiny, tiny portion of our solar system. The questions about space still far outnumber the answers. Aerospace engineers help to fill in some of the missing puzzle pieces.

Neil Armstong made this foot print on themoon in 1969. It's probably still there!

Aerospace engineers deal with all aspects of space flight. They design, analyze, and test spacecraft, spacecraft components (like the Canadarm, pictures at left), remote control rovers, satellites and now, even space stations which orbit the earth. Their work may include aerodynamics, propulsion systems, structural design and analysis, flight and orbital mechanics and systems integration. They may even work designing the future: figuring out how humans can travel to and live on the Moon, Mars and maybe eventually beyond the bounds of our own solar system.

In the twentieth century, aerospace engineers have allowed us to observe space from beyond the Earth. Men have walked on the moon, unmanned spacecraft have visited Mars and Venus and have flown past planets in our solar system. However, aerospace technology is not only used to travel great distances, but to help people on earth as well. For example, satellites discovered the ozone hole over Antarctica and gave us photographs of the nuclear power plant disaster of Chernobyl. They also help to pinpoint forest fires, locate boats lost at sea and warn us about approaching hurricanes and tornadoes. And if you think all of this high tech machinery has nothing to do with Aboriginal people, think again: the Global Information System (GIS) - which uses satellite images of the Earth and other integrated digital geographical data - is proving to be very helpful in mapping out traditional territories for land claims negotiations.

NATIVE ENGINEERS & SCIENTISTS

A place to meet people from your community.

Name: Tara Williams
Nation: Mohawk
Profession: Biologist
School: Universit**é** de Montr**é**al
Degree: B.Sc. Microbiology and Immunology
Favourite thing about her job: Getting to work on Space Shuttle and International Space Station missions.

Tara Williams in the Multi-Purpose Support Room, Johnson Space Centre, Houston, Texas.

Tara Williams went into sciences because she wanted to "open as many doors as possible." She would never have guessed that one of those doors would open during a vacation to Russia! In Moscow she met an American doctor who happened to be a Flight Surgeon for NASA. "I asked him if they needed any biologists. He told me who to contact and here I am."

"Here" is in Building #29, NASA's Medical Operations Branch at the Johnson Space Centre in Houston, Texas. She also works and trains in several other buildings including Mission Control. Although she is still in training, Ms. Williams is already working on missions because each space shuttle flight takes months, sometimes years of planning.

Her official title is Biomedical Flight Controller but that doesn't tell you much about her job. She actually works with a team of other Flight Controllers, Flight Surgeons and astronauts to make sure medical procedures and/or experiments on shuttle flights (and soon on the International Space Station) will go as smoothly as possible. Before a shuttle mission she may help train astronauts in medical procedures like administering shots. She is also responsible for overseeing and updating a book of procedures which astronauts may have to perform in medical emergencies. During flights she and other Biomedical Flight Controllers,

> "provide support for the Flight Surgeons from a back room called the Multi-Purpose Support Room. We monitor the astronauts heart rates while they are out in space on EVA (space walks), as well as environmental data such as cabin pressure, oxygen and carbon dioxide levels. If a medical procedure needs to be performed, we follow along and answer any questions the astronauts may have. We also set up private medical conferences so the Flight Surgeon can talk to the astronauts, and arrange for private family conferences."

As Ms. Williams says "It's very exciting to work with astronauts and space."

Ms. Williams had several interviews at other companies before she got the job at NASA. She says it was discouraging not to get jobs. Now that she has found a job she loves, she has advice for other Aboriginal students trying to decide on a career, "Don't settle for anything that you don't want to do. I was working in a grocery store and I hated it, but I had a job so I wasn't looking as hard as I should have been. It's really important not to give up."

Becoming an Astronaut

The Canadian Astronaut Program began in 1983. Since then it has issued two calls for potential space cadets and more than 9000 Canadians applied! Just getting past the interview isn't easy. Candidates undergo medical and psychological testing and countless interviews. Those lucky few who are selected go back to school. Astronaut trainees study Earth observation, geology, oceanography, astronomy, photography and life support in microgravity environments. They learn how to pilot and jump out of planes as well as how to work in weightless conditions. (They practice under water and in a roller coaster of an airplane known as the Vomit Comet.) Before they're allowed to leave Earth potential astronauts also have to become expert in survival and wilderness training, first aid and shuttle evacuation procedures. Needless to say becoming an astronaut takes a lot of hard work and dedication!

Aurora Borealis: Northern Lights

At night the northern sky sometimes almost seems alive. Lights shimmer and gleam, moving across the sky in great swaths of red, green, white and blue. These are the northern lights, the Aurora Borealis. The Inuit tell us that the aurora are made by the torches of ancestral souls lighting the way to the afterlife. The Ojibway say they are torches of the manabai'wok, great hunters and fisherman, who light the night sky as they spear fish. Beautiful and mysterious, the northern lights inspire awe and the imagination. Astronomers, physicists and aerospace engineers, inspired to study the northern lights because of their beauty, have discovered what causes them. Their tale is as fascinating as that of the Inuit or Ojibway.

The Earth sits 93 million miles away from the sun, swaddled in a thin layer of oxygen, nitrogen and other gases which bring us life. In the middle of the planet a molten core of iron and other metals creates a giant magnetic field around the Earth. It emerges and is strongest at the poles and extends far out into space. Scientists call this field the magnetosphere.

Far away, the sun lies in the centre of the solar system, producing light, heat and other forms of energy. It is a violent place. Its atmosphere, totally unlike that of Earth, consists of ionized gas; charged particles of hydrogen and helium which get pushed away from the burning ball at supersonic speeds. These particles are known as the solar wind. It blows constantly, reaching out past the farthest planets in our system.

The solar wind travels for two days before reaching Earth. When it arrives some of its particles get caught in the magnetosphere. Trapped, they start spiraling down the magnetic field towards the planet's poles. When they enter the atmosphere something almost magical happens; particles from the distant sun hit atoms of oxygen or nitrogen or other gases. These collisions give off energy, much of it in the form of visible light. It is this light which shimmers across the sky, in the bands, waves and dancing forms of the Aurora Borealis.

COMMUNITY PROFILE

Churchill, Manitoba

The land of bark canoes and tamarack toboggans is Canada's rocket launch capital!

Lying on the western shores of Hudson Bay, about 1000 km north of Winnipeg, Churchill, Manitoba is one of the many cities in Canada with a significant (almost 40%) Aboriginal population. It is made up predominantly of Chipewa and Swampy Cree. Historically, these peoples would set up temporary villages in and around the site now occupied by the city. Churchill is known as the "Land of Nanuk" (the polar bear), and residents of the city still occasionally see polar bears walking their streets. They also share the community with beluga whales - which feed and calve in the harbour during the summer - seals, caribou and rare migrating birds. It is a beautiful area surrounded by clean water, unspoiled land and fresh air, and yet visitors are often drawn here because of the sky; at night the Aurora Borealis is spectacular.

Churchill offers another advantage with respect to the heavens; its northern location makes it an ideal place from which to launch low earth orbit satellites and scientific instruments. In fact, between 1957 and 1985 Churchill was home to the Rocket Research Range, a project jointly funded by Canada's National Research Council and the National Aviation and Space Administration (NASA) in the United States. For more than 25 years the rocket range was used over 3,500 times to launch research and meterological equipment using sounding rockets.

Sounding rockets are used to carry out short-term experiments at high (but not orbital) altitudes. The rockets get high enough to escape most of the vibration effect of the Earth; they operate in what is called a microgravity environment. They are launched along an arc-shaped trajectory, which usually allows the rocket to remain in the microgravity environment anywhere from 5 to 20 minutes as it reaches the top of its trajectory; this is usually the point at which its payload experiments are carried out.

While the Rocket Range closed in 1985, there have been a number of projects proposed for the site. One of them is Project Skywalker, a proposed commercial sub-orbital Reusable Launch Vehicle (RLV) that will be used to carry researchers to an altitude of at least 100km. Although no new projects have been approved for the site as yet, Churchill may soon once again help us in our understanding of our planet and the space beyond it.

Fun Facts and Things to Think About

They came to a round hole in the sky, burning like fire, "This," said the Raven, "is a star."

Inuit creation story

Source: Cosmic Quotations
http://www.ac.wwu.edu/~skywise/cosmo.html

Did you know ... the sun's activity peaks every 11 years? At the height of it's cycle there are more solar flares than usual. More solar flares means more solar wind, and that means more active northern lights for us. It also means that northern lights get seen much further south than usual.

Source: What causes the northern lights?
http://www.imv.uit.no/english/science/publicat/waynorth/wn1/part03.htm

Did you know ...
... aerospace engineers use sling shots? It's not the same kind of slingshot used for hunting but it works in a similar way. Spacecraft travel close to a planet or a moon and use the gravity to slingshot themselves off in a new direction with great speed. This was the method that NASA used to bring the Apollo 13 crew safely back to Earth, it is also what happens to comets when they travel around the sun.

It is like furnishing a new home.
- Julie Payette, about the Space Shuttle's first visit to the International Space Station.

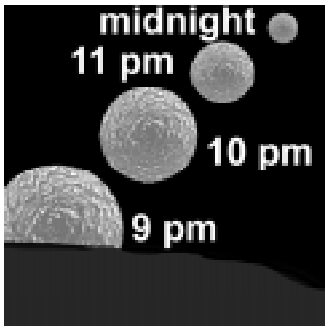
You've probably heard of "Buzz" Aldrin, Neil Armstrong and John Glenn. Do you know what they have in common with Robert Thirsk, Dave Williams and Bjarni Tryggvason? The answer is that they've all orbited around the Earth in a spaceship.

Thirsk, Williams and Tryggvason are three of the 7 Canadians who have left Terra Firma to travel into space. The others are:
Marc Garneau, the first Canadian in Space;
Roberta Bondar, the first Canadian woman in space;
Julie Payette, the youngest Canadian in space and the first to work on the International Space Station;
Chris Hadfield, the first Canadian to space walk! (No, not like Michael Jackson!)

PUZZLES & GAMES

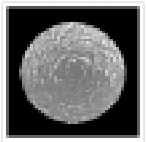
You walk out of your house one night and there is the full moon just starting to rise on the horizon. It looks beautiful! It also looks huge. You rush inside, grab your camera and come back outside to take a photograph. Then, because it such a beautiful night, you decide to take a series of moon photos as it rises to its highest point in the sky.

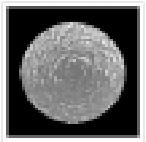
This is what you saw …



and these are how your photos turned out.


9 pm


10 pm


11 pm


midnight

What happened?

When Russia and the United States started to experiment with space flight, no one was sure that humans could even survive in space, so the first rockets carried animals into space. Which one of the following animals has never been in space?

Brine shrimp
A Cat
A Chimpanzee
A Dog
Jelly fish

ALL ABOUT US

The Native Access to Engineering Program at Concordia University is a joint project of the Faculty of Engineering and Computer Science and l'Ordre des ingénieurs du Québec. It has been running since 1993 with the goal of introducing young Aboriginal people and their teachers to engineering and its connection to economic development. The project's ultimate goal is to increase the representation of Aboriginal peoples among the ranks of professional engineers in Canada.

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