

# Turtle Mountain: the anatomy of a disaster

BY PAUL HUGHES

REPORTER

Thanks to the pioneering efforts of the Alberta Geological Survey, the Municipality of Crownsnest Pass now has the hard hazard data on Turtle Mountain and more specifically, the danger posed by the South Peak.

An international community of slide experts has analyzed data gathered from Turtle Mountain and the monitoring of the South Peak is an ongoing 24/7 endeavour, with real time information capture occurring every second of the day.

"On our end, we are providing the data and the science of what is happening, so that

the different levels of government, who have that jurisdiction, can make the decisions. We're [AEUB/AGS] happy with our role. It is simple from that respect, it is completely scientific and is not political, which is nice," said Cory Froese, Geohazards team leader.

"People have not had hard data to look at. This is real data and it is nice to hear that there is confidence in it," added Froese.

By March 31, 2005, a state-of-the-art predictive monitoring system was designed and positioned by virtue of a funding commitment made by the Alberta government on the 100th anniversary

of the Frank Slide. Implementing the project required a collaborative effort between contractors, the Government of Alberta, and universities.

Froese and his team are using the real time monitoring to collect the data. Some of the cutting edge monitoring equipment being used includes:

**LIDAR** allows the geohazard team to see the subtle features of the mountain by removing the organic features such as vegetation and revealing the actual faults and cracks, of the naked mountain. It is a lot like shaving the beard (vegetation) off the mountain.

**Crackmeters:** The most sensitive of all the devices. Crackmeters can detect changes as small as 10 microns - the thickness of a human hair - in the width of fissures and cracks. There are 20 such gauges installed on the mountain.

**Surface Extensometers:** These gauges measure

rock mass displacement once an hour and consist of long steel cables anchored at one end and hung over a pulley with a weight at the other end. Movement is read and stored on a datalogger before being sent to the Frank Slide Interpretive Centre.

**Tilt Meters:** Not unlike a very precise electronic carpenter's level, these meters record rock mass rotation. There are 10 tiltmeters deployed along the South Peak's highly-fractured summit.

**GPS:** Four Global Positioning System stations have been established to monitor rock mass movement to within 7 mm, about half the width of a penny.

**Satellite Interferometry:** In conjunction with the Canadian remote Sensing Centre, satellite radar images are combined to detect movement as small as one centimetre. This analysis is performed every three months.

**Seismic Moni-**



Bryan Passifiume photo

## The Frank Slide.

toring: The same technology used to detect and rate earthquakes. The gauges used on Turtle Mountain are sensitive enough to observe mine blasting in Elkford. Not unlike

a stethoscope, collecting seismic data is similar to listening to the mountain's heart.

**Mine Water Outflow and Pore Pressure:**

Water pressure is monitored by measuring the outflow of water from a spring that originates inside the workings of the old Frank Mine. Pore pressure is determined by merging data from the weather stations and the spring outflow.

**Weather Station:** The station is located 100m south of the South peak and collects meteorological data such as air temperature, relative humidity, rain fall, wind speed, wind direction, barometric pressure, solar radiation and rock temperature. The weather data is measured every five seconds. Although the technology for monitoring weather may be at the low end of the tech scale for the Turtle Mountain project, it has been weather

events that have seen the greatest movement of rock mass.

High rainfall combined with cool temperatures saw a 30 mm rock mass movement when the rain water froze within the cracks.

The freezing water adds weight to the mountain.

The collective data from all the monitoring sensors allows the scientists to establish trends such as the direction the mountain is moving in.

More importantly, it provides the information required to determine how stable, or unstable, the mountain is.

Ultimately, the ability to predict the stability of the mountain will be found in the science that Froese and his team are pioneering.

The primary purpose of the system is to provide early warning of any significant rock mass movement on Turtle Mountain, thereby mitigating

risk to the public.

In addition to enhancing public safety, there is an opportunity for significant scientific research and advantages to public education and tourism through displays at the Frank Slide Interpretive Centre.

"Presently, the forces holding the mountain up are greater than the forces pushing and pulling it down. In 1903, if you looked at reports of the weather on and before April 29, they had high snow melt, rapid thaw and then on the night of April 29, the temperature dropped significantly. The mountain was already moving prior to the Frank Slide, but that was the final straw," said Froese.

Froese, summing up the team's position after three years of monitoring Turtle Mountain, said, "We're on top of it."

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