Web posted March 25, 2007

Getting to the bottom of it: Tech team explores Mendenhall depths

Experts from University of Alaska Southeast and U.S. Army ran radar test

By KORRY KEEKER
JUNEAU EMPIRE

A research team hopes radar can unlock the glacial mysteries of Mendenhall Lake by exploring the layers of sediments underneath the lake's bed.

Michael Penn / Juneau Empire

Test run: Allan Delaney of the Cold Regions Research and Engineering Lab (CRREL) in Fairbanks checks the connections on a ground penetrating radar during research on Mendenhall Lake on Thursday.

Eran Hood, associate professor of environmental science at the University of Alaska Southeast, and technicians from the Fairbanks-based U.S. Army's Cold Regions Research and Engineering Lab spent Wednesday and Thursday mornings dragging a ground penetrating radar system across the frozen lake surface with a snowmachine.

The project was delayed two or three weeks ago due to high winds and snow. It was halted Thursday, when wet conditions shorted out the radar control.

"It's pretty much a testing run," Hood said. "We do a lot of measurements of depth just using a depth-sounder like a fish-finder. But the radar looks into the sediment. We're trying to work with (CRREL) to see how far into the sediment we can see and what we can see in terms of layers of sediments."

SpringBoard, a program of the Juneau Economic Development Council, helped arrange the partnership with UAS and CRREL.

Ground penetrating radar can peer through ice, water and more than 15 meters into sediments to create a map of a subsurface.

The technology is commercially available and manufactured by a Geophysical Survey Systems, a New Hampshire-based company. It uses a fairly low frequency of 100 Mhz.

GPR was developed in the 1970s during the Vietnam War to find tunnels and land mines. Since then, it's proven to be invaluable in mapping underground utilities, archaeological sites and sediments and cavities beneath the earth's surface.

"The idea is to generate a pulse with a transmitter and send it down and look for reflections or echos of different material types," said Alan Delaney, a physical sciences technician with CRREL.

Delaney has operated geophysical instruments and this kind of radar for the last three decades. His work takes him all over Alaska and Antarctica.

In Alaska, he's conducted most of the investigations at Fort Richardson and Fort Wainwright to profile bedrock and search for buried debris. Delaney also did a lot of work at the old Haines fuel terminal to identify patterns or fractures in the bedrock that could be paths for contaminated groundwater from the terminal.

Delaney has also used the system for many projects in Antarctica. Radar pulses travel a long distance in fresh ice, and the equipment can map and define crevasses on transportation haul routes. GPR has been used to plot a 738-mile hazard-free route from McMurdo.

When exploring sediment, the radar's success is dependent on the type of soil. The amplitude of a pulse will diminish rapidly in in silts and clays.

Mendenhall Lake was chosen because of its dynamic glacier enviroment. The water is extremely fresh, and its low conductivity means radar works well.

Sea water, on the other hand, has a high conductivity. That causes the amplitude of a radar pulse to decrease quickly.

"The idea was that if the data looked good we could conduct more extensive profiling and perhaps have a joint study with UAS," Delaney said.

An acoustic system could be used to profile the depth of the lake and build a contour map. But the long pulses of an acoustic system wouldn't reveal much information about the layers of bed sentiments.

Radar works better to examine the fine structures that represent annual sentiment accumulation, Delaney said.

The system has two antennas - a transmitter and a receiver - separated by six feet. A control cable extends from the antennae to the radar control unit.

Once the machine was tuned and generating a signal from the bottom of the lake, the team slowly swept across the lake on a snowmachine donated by Ray Howard of the Juneau Snowmobile Club.

The transmitter sent out pulses, which were mapped to generate scans of vertical sections of the lake.

"It looks like that we might have had several meters of bed penetration," Delaney said. "You could see a strong reflection from the water sediment.

"The next step would be for Eran to go out there and collect some sediment samples to find out whether the material is silt or clay," he said. "Then we can determine the velocity of the waves traveling through the sediments and come up with a sediment depth."

• Korry Keeker can be reached at korry.keeker@juneauempire.com

► Science at work: Eran Hood, associate professor of enviromental science at UAS, drives a snowmobile as Alan Delaney of the Cold Regions Research and Engineering Lab in Fairbanks monitors data.