INSTITUTE FOR GEOPHYSICS
JACKSON SCHOOL OF GEOSCIENCES
University of Texas at Austin | 4412 Spicewood Springs Rd. #600 Austin, TX 78759-8500 USA | Phone: 512-471-6156 | Fax: 512-471-8844

News Release

UTIG Contact:
Kathy Ellins
512-471-0451
kellins@ig.utexas.edu

See also:
UT Office of Public Affairs
UTIG Press Releases
AGASEA Article
AGASEA Project

For release:
November 18, 2004

Scientists from The University of Texas Institute for Geophysics and the British Antarctic Survey mount a massive aerogeophysical field campaign to study fast-flowing glaciers in the Amundsen Sea Embayment, Antarctica.

Austin, TX – For the past three weeks, The University of Texas Institute for Geophysics (UTIG) Antarctic Airborne Geophysics group has been living and working at McMurdo Station, Antarctica.

The UTIG team of scientists, technicians, and students arrived at McMurdo on a ski-equipped LC-130 Hercules aircraft after a 20-hour trip from Austin via New Zealand. They are currently spending the long night-less days of the austral summer preparing for one of the largest field projects the continent has ever witnessed—an airborne geophysical survey of the Amundsen Sea Embayment, Antarctica (AGASEA).

The more than three kilometers-thick ice within the Amundsen Sea Embayment (see map below) is recognized as the part of the unstable West Antarctica Ice Sheet (WAIS) with the greatest potential for collapse as a result of climate warming. Current studies show that the ice within the Amundsen Sea Embayment is "melting, thinning, and retreating rapidly, contributing to global sea level rise," explained UTIG scientist Jack Holt.

Of particular concern to scientists are the Pine Island and Thwaites Glaciers, two of the fastest-flowing glaciers in Antarctica. Satellite studies compiled over the last few years show that the Pine Island Glacier is thinning at a rate of up to 6 meters per year and that the Thwaites Glacier thinned 25 meters between 1991 and 2001. The direct cause for this thinning is poorly understood.

Scientists are concerned that these glaciers are out of balance. Although the Amundsen Sea Embayment has one of the highest rates of snow accumulation in Antarctica, more ice is lost each year to the ocean than is replenished by snowfall. This is alarming because the cause must be a recent phenomenon that cannot be sustained unless the ice sheet in that region is undergoing a major change.

The AGASEA project will acquire geophysical data for a comprehensive study of the drainage basins of the Pine Island and Thwaites Glaciers—a 290,000-square-kilometer area (roughly the size of New Mexico) that is poorly understood due to its notoriously poor weather and the great distance from McMurdo (over 2000 kilometers)—through a collaboration involving UTIG and the British Antarctic Survey. Results from AGASEA will provide many scientists the information needed to model future ice sheet behavior and potential effects of climate change.

“The goal of our experiments is to not only identify where changes are occurring in the ice sheet, but to also understand why the changes occur,” said David Morse of UTIG. “Once we know why changes are occurring, then we can begin the process of predicting the importance of ice sheet dynamics on global sea level and climate change.”

To carry out the AGASEA project, two remote field camps will be constructed and maintained—an endeavor that will require forty-one LC-130 flights. UTIG’s field party and British Antarctic Survey scientists will each occupy and work from one of the field camps and operate aircraft crammed with highly sophisticated geophysical instrumentation capable of operating in the extreme Antarctic environment. The two groups will focus data collection efforts in different areas of the survey area to maximize coverage.

Gearing up for a three-month survey of the Amundsen Sea Embayment is no small task. The remote field location requires the 15-person science team, headed by Holt, to assemble and test the team’s equipment at McMurdo Station prior to deep-field deployment. While at McMurdo Station the UTIG group will configure a ski-equipped DeHavilland Twin Otter aircraft with a laser altimeter, a gravimeter, a magnetometer, and, according to UTIG’s Don Blankenship, “the world’s most powerful ice-penetrating radar sounder.” Once established in the deep field at a camp built for this project, the team will conduct three 1000-km survey flights per day, operating around the clock with multiple shifts in order to take advantage of times of good weather and the limited field season.

Laser altimetry data obtained during the AGASEA project will provide more accurate measurements of the present surface elevation and ice thickness. This will help to establish a benchmark for future satellite altimetry studies which will record the same information but from a much greater distance.

Gravity and magnetic data will identify tectonic elements like faulting and volcanism that may contribute heat to the system and influence flow of overlying glaciers.

Ice-penetrating radar provides images of what lies many kilometers below the ice surface. Knowledge of ice layers and sub-ice topography will help scientists understand historical snow accumulation rates and how annual precipitation affects glacial flow and the overall balance of the WAIS. Studies of the ice sheet base and the topography of the rocks beneath it will reveal how these factors affect ice sheet development and movement.

“The power of our approach is to combine what would usually be completely separate glaciological and geological investigations. Basically, an understanding of ice sheet behavior requires an intimate knowledge of what lies at the ice sheet base. An interdisciplinary approach allows us to see many angles of one science problem,” explained Blankenship.

Ground operations in McMurdo include testing base station magnetometers and GPS equipment. “Static (or non-moving) measurements are required from a variety of instruments in order to anchor the kinematic (or moving) measurements we get from the instruments in the plane,” said Theresa Diehl, a UT graduate student.

“We need to record the magnetic field in order to establish the average field. We subtract this from our measurements later,” Diehl explains. “There are a few hours in the day when the sun interferes with the magnetic field and causes high noise levels in our readings. So, we make measurements for 24 hours to identify the high noise time interval, flagging it as the time during which we won’t fly the airplane.”

Test flights from the sea ice runway near McMurdo Station will ensure that scientific equipment installed in the aircraft is operational and that base and aircraft instrumentation work in tandem.

UTIG scientists also worry about West Antarctica’s fickle weather. “The Amundsen Sea Embayment has some of the worst weather in the world,” said Hunter Danque, a graduate student at UTIG who tracked several years’ worth of weather satellite photos taken over the survey area.

Jack Holt agrees. “We had to understand the weather as best we could to choose field camp locations that would be most favorable to our flight operations. It wasn’t easy,” he said.

Low pressure cyclones bring snow and ice-laden winds at speeds often exceeding 300 kilometers per hour. Storms are driven landward as they approach the Antarctic Peninsula. Ice fog is another persistent hazard that obscures depth perception and division between the snow surface and the sky. Either situation may render flying impossible for several days at a time.

When asked about the danger and logistical pains involved in UTIG's field program, Blankenship commented, "Both the cost and the human effort required to acquire useful geophysical data in such a remote region of Antarctica is enormous. However, the geophysical results that we will obtain from the Amundsen Sea Embayment will be a uniquely important resource for the entire scientific community. Without these results we simply would not be able to understand what Antarctica has in store for us in terms of global climate and sea-level change."

The UTIG AGASEA project is funded by The U.S. National Science Foundation's Office of Polar Programs.

The University of Texas Institute for Geophysics (UTIG) is known internationally as a leading academic research group in geology and geophysics. Founded in 1972, it is a part of the John A. and Katherine G. Jackson School of Geosciences at The University of Texas at Austin.