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NEWSLETTER FOR THE

Canadian Antarctic Research Network

Inside

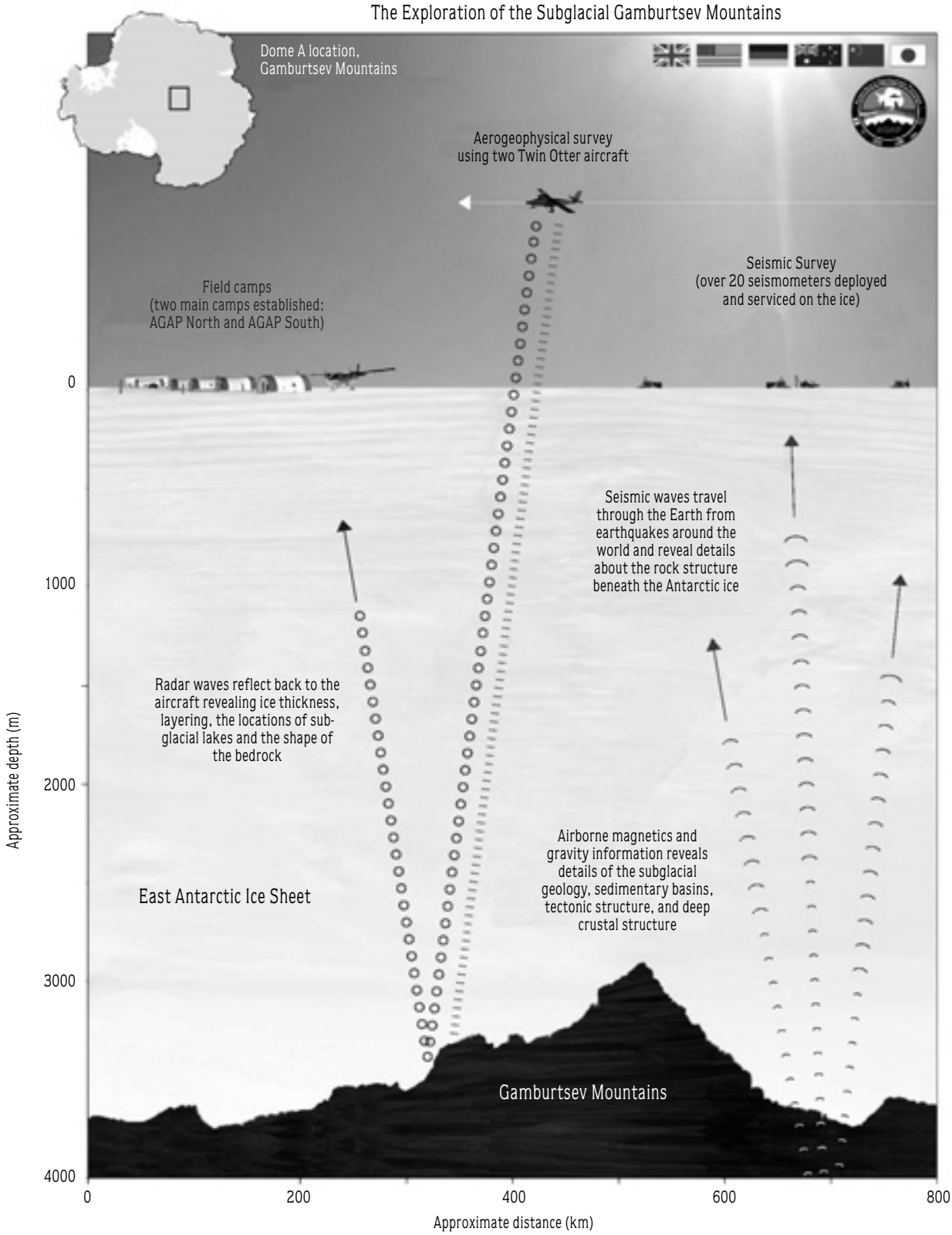
Sander Geophysics Explores the Antarctic

Sander Geophysics Limited (SGL) has earned the privilege of participating in the Antarctica's Gamburtsev Province Project (AGAP). This is a project funded by the US National Science Foundation's Office of Polar Programs for International Polar Year (IPY). In May and June of 2007, teams from SGL and the Lamont-Doherty Earth Observatory of Columbia University installed SGL's Airborne Inertially Referenced Gravimeter (AIRGrav) in a Kenn Borek DCH-6 Twin Otter aircraft in Calgary. Once installed, the aircraft performed test flights over the Rocky Mountains and was then flown to Ellesmere Island in Nunavut to test the system at high latitudes over the North Pole. The tests proved very successful in terms of AIRGrav data quality, noise levels, and GPS control. This success led the AGAP team to select AIRGrav over other gravimeters for the demanding Antarctic survey. The Rockies tests have been described by Studinger and others (2008). In May and June 2008, teams from SGL and AGAP returned to Calgary where they installed the AIRGrav system along with the full suite of AGAP geophysical equipment in the Twin Otter. The aircraft flew a set of successful test flights over the Greenland ice sheet as a final verification of the survey platform before heading south to Antarctica.

The AGAP's central focus is to gather information to accurately characterize the tectonic origin of the Gamburtsev Subglacial Mountains, approximately 3 km below the million-year-old ice sheet in the deep interior of East Antarctica (Fig. 1). In addition, the project will study the relationship between these mountains and the overlying ice sheet and subglacial lakes, and identify the location of the oldest ice to enable the recovery of the oldest climate record. The survey will take place from December 2008 to January 2009. The team from SGL, that will join the AGAP team in Antarctica, consists of SGL Data Processing Manager Dr Martin Bates, Senior Geophysicist Stefan Elieff and Technician Daniel Geue. SGL's AIRGrav system will collect information about the buried mountains' structure during the combined airborne gravity and magnetic survey. The Lamont-Doherty Earth Observatory of Columbia University will operate a laser altimeter that will simultaneously scan the surface of the ice during flights to provide information on surface elevation, a synthetic aperture radar (SAR) that will measure ice thickness and layering in order to map the shape of the buried bedrock, and magnetometers to map the magnetic fields of the bedrock.

Sander Geophysics' AIRGrav system (Fig. 2) offers a number of advantages over competing systems, including:

1. Significantly better resolution and accuracy;
2. Ability to operate under normal daytime flying conditions;
3. Ability to provide high quality gravity data while flying in drape mode;
4. Ability to provide good quality aeromagnetic data concurrently with the AIRGrav data;
5. Significant operational efficiencies;
6. Shorter time required for data acquisition and processing.


The Exploration of the Subglacial Gamburtsev Mountains
Dome A location,
Gamburtsev Mountains
Aerogeophysical survey
using two Twin Otter aircraft
Field camps
(two main camps established:
AGAP North and AGAP South)
Seismic Survey
(over 20 seismometers deployed
and serviced on the ice)
Seismic waves travel
through the Earth from
earthquakes around the
world and reveal details
about the rock structure
beneath the Antarctic ice
Radar waves reflect back to the
aircraft revealing ice thickness,
layering, the locations of sub-
glacial lakes and the shape of
the bedrock
Airborne magnetics and
gravity information reveals
details of the subglacial
geology, sedimentary basins,
tectonic structure, and deep
crustal structure
East Antarctic Ice Sheet
Gamburtsev Mountains
Approximate depth (m)
0
1000
2000
3000
4000
0
200
400
600
800
Approximate distance (km)

These advantages are all a result of the unique design and construction of the AIRGrav system. It accurately records and compensates for aircraft movements due to turbulence, aircraft vibrations, and drape flying, allowing for the removal of these effects from the final data during processing. Very high quality GPS, combined with SGL's proprietary GPS and gravity data processing software complete the AIRGrav system. AIRGrav system details are available on SGL's website (www.sgl.com) as well as in our Technical Papers.

References

Studinger, M., R. Bell and N. Frearson, 2008. Comparison of AIRGrav and GT-1A airborne gravimeters for research applications. *Geophysics*, **73**(6), I51–I61.

Additional information on this project is available from the Lamont-Doherty Earth Observatory website for the AGAP (www.ldeo.columbia.edu/res/pi/gambit).

Figure 1 (left)
Diagram showing the various geophysical techniques being used to study the Gamburtsev Mountains. Illustration courtesy of AGAP.

Figure 2
Photo of AIRGrav installed in the Kenn Borek DCH-6 Twin Otter ready for surveying. Courtesy Michael Studinger, Doherty Research Scientist for AGAP.

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