High Resolution Magnetic Gradiometer Surveys

Fixed-Wing or Helicopter

Sander Geophysics offers low level magnetic gradiometer surveys of very high resolution and accuracy using fixed-wing aircraft and helicopters. The gradiometers use two cesium magnetometers with a fixed separation to measure the earth's vertical and/or horizontal magnetic gradient. Total magnetic field measurements are recorded simultaneously.

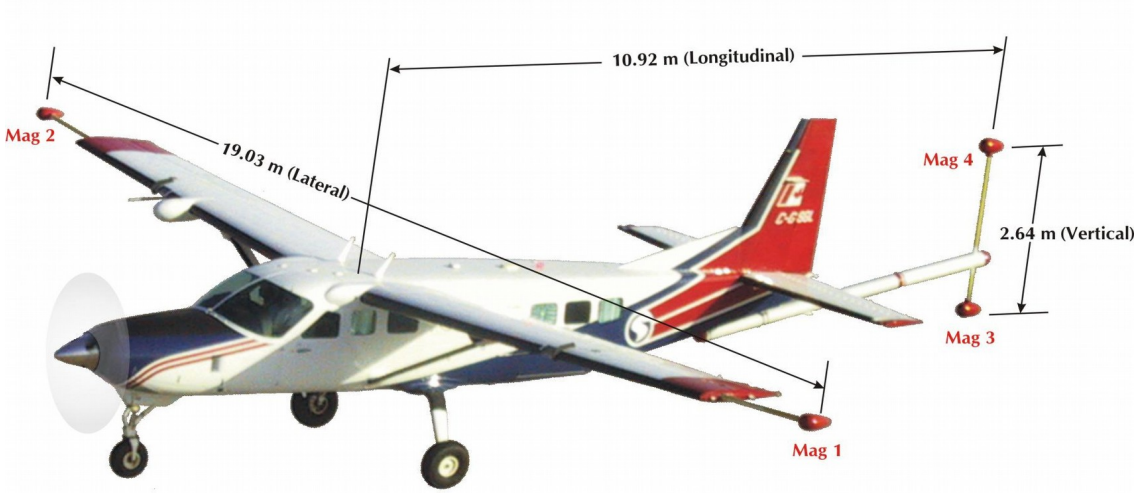
The vertical magnetic gradient offers a better means of detecting near surface magnetic sources than total magnetic field measurements, making the vertical gradient method ideal for mineral prospecting. Gradiometer surveying can obtain exceptionally detailed data by flying at low altitudes and moderate speeds.

Horizontal gradients provide detailed near-surface information, and help to interpolate between survey flight lines. This is especially important if the survey target has similar dimensions to the survey line spacing. Both gradients are much less affected by diurnal changes in the magnetic field so they are ideal for use in areas where significant diurnal magnetic activity is expected.

GRADIOMETER SURVEYS AT SGL

We use optically pumped cesium magnetometers with a sensitivity of 0.005 nT, and real-time digital compensation, giving an overall system resolution of 0.01 nT. The magnetometers in the aircraft and in the reference station are identical, ensuring that all magnetometer data sets are equivalent in terms of sensitivity and noise envelope. The sampling rate can be adjusted depending on survey requirements, with most surveys delivered at 10 Hz.

Cesium magnetometers are ideally suited for gradiometer surveying because of their very high resolution and exceptional stability. Flight direction changes do not require reorientation of the magnetometer sensors.



Sander Geophysics' Magnetic Gradiometer System

Good navigation and accurate flight path recovery are very important considerations for high-resolution airborne gradiometer surveying. Our aircraft are equipped with Global Positioning System (GPS) receivers integrated into a proprietary navigation and flight path recovery system. This system, called **SGNav**, allows for excellent navigation and provides an accuracy of better than 1 m in post-flight recovery.

Sander Geophysics is well equipped to provide data processing, a variety of map presentations and interpretation services to enhance the usefulness of its vertical gradient surveys.

<table>
<tr><th colspan="6">AIRBORNE INSTRUMENTS</th></tr>
<tr><td>Magnetometer Sensor</td><td colspan="5">Geometrics
Strap-down, optically pumped, cesium split beam
Sensitivity: 0.005 nT Sensor noise level: < 0.02 nT Sampling rate: 10 Hz
Sensor Separation
Helicopter: 3.0 m vertical
Fixed-wing: 2.64 m vertical and 19 m horizontal
Gradient Noise Level
Vertical: less than 0.02 nT/m
Horizontal: less than 0.005 nT/m</td></tr>
<tr><td>Compensator</td><td colspan="5">Sander Geophysics – AIRComp real-time digital compensation
Range: 20,000 to 200,000 nT Resolution: 0.001 nT Sampling rate: 160 Hz</td></tr>
<tr><td>Data Acquisition System</td><td colspan="5">Sander Geophysics – SGDAS airborne computer
Capable of recording an unlimited number of channels at variable intervals, and providing a digital scrolling chart display of the data. Data is recorded on a vibration tolerant removable drive. The system clock is a quartz time standard automatically synchronised to UTC by the GPS signal to an accuracy of 1 millisecond.</td></tr>
<tr><td rowspan="4">Radar Altimeter</td><td></td><td>Resolution</td><td>Calibrated to</td><td colspan="2">Range</td></tr>
<tr><td>TRT AHV8</td><td>0.5 m</td><td>1%</td><td>0 to 3,050 m</td><td>(10,000 ft)</td></tr>
<tr><td>King KRA-10</td><td>0.1 m</td><td>1%</td><td>0 to 60 m</td><td>(2,500 ft)</td></tr>
<tr><td>FreeFlight</td><td>0.5 m</td><td>1%</td><td>0 to 760 m</td><td>(2,500 ft)</td></tr>
<tr><td>Barometric Altimeter</td><td>Sander Geophysics Digitally Recording Barometric Altimeter</td><td>2.0 m</td><td>+/- 4 m</td><td>0 to 10,000 m</td><td>(33,000 ft)</td></tr>
<tr><th colspan="6">REFERENCE STATION INSTRUMENTS</th></tr>
<tr><td>Magnetometer Sensor</td><td colspan="5">Same as airborne</td></tr>
<tr><td>Magnetometer Interface</td><td colspan="5">Sander Geophysics – SGRef
Range: 20,000 to 100,000 nT Resolution: 0.01 nT Sampling rate: 2 Hz</td></tr>
<tr><td>Data Acquisition System</td><td colspan="5">Sander Geophysics – SGRef
This system runs SGL data acquisition software capable of recording an unlimited number of channels at variable intervals, and providing a digital scrolling chart display of the data. Data is recorded on a vibration tolerant removable drive. The system clock is a quartz time standard automatically synchronized to UTC by the GPS signal to an accuracy of 1 millisecond.</td></tr>
<tr><td>Power Source</td><td colspan="5">12 VDC can be wind or solar powered</td></tr>
<tr><th colspan="6">NAVIGATION INSTRUMENTS</th></tr>
<tr><td>Global Positioning System</td><td colspan="5">NovAtel – GNSS (Global Navigation Satellite System), reference and airborne
Sampling rate: 20 Hz</td></tr>
<tr><td>Real-Time Differential GPS</td><td colspan="5">Satellite link to the aircraft for real-time in-flight differential GPS (RDGPS), if required</td></tr>
</table>