High Resolution Frequency–Domain EM Surveys

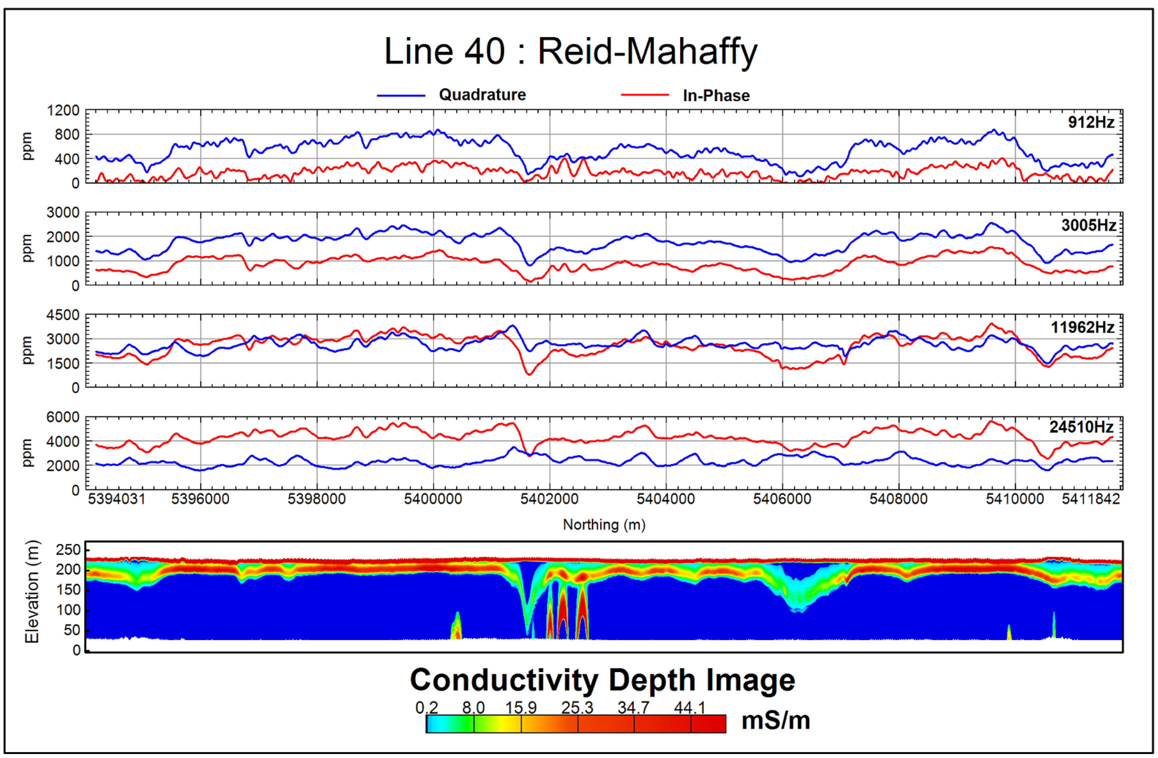
Sander Geophysics has sixty years of worldwide experience in high resolution airborne surveys and flew its first electromagnetic (EM) survey in 1958. SGL offers frequency-domain electromagnetic (FEM) surveys using a fixed-wing aircraft. FEM systems generate electromagnetic fields (primary field) which in turn induce secondary EM fields that vary in amplitude and phase depending on the electrical conductivity of the medium. At SGL, this secondary field is measured by the receiver coils and then separated into two components: the in-phase (or real) component which is in-phase with the primary field and the quadrature (or imaginary) component which is 90° out-of-phase with the primary field. The relationship between the signal strengths of the two components is then used to estimate the conductivity and depth of measured anomalies. This system can be used for both mineral exploration and environmental programs to:

- map lateral changes in geological conditions such as changes in lithology and structure, as well as presence of ore bodies;
- perform groundwater investigations;
- detect large buried metal objects.

SGL's de Havilland Twin Otter on survey in Ireland

AIRBORNE FREQUENCY-DOMAIN EM SURVEYS AT SGL

SGL's de Havilland DHC-6 Twin Otter can be configured with a four-frequency wingtip mounted EM system (SGFEM). This configuration results in a large transmitter-receiver coil separation which improves the signal to noise ratio. This allows surveys to be flown higher, thus making the system a viable option for surveying in areas where local regulations restrict minimal flying altitudes.



Test line over the Reid-Mahaffy test site in Ontario showcasing all electromagnetic components in profile plus CDI generated from all SGFEM frequencies. The targets of interest can be seen in the centre of the CDI along with the overburden across the entire length of the line.

The transmitter-receiver coil pairs are mounted in a vertical-coplanar orientation, which reduces noise by minimizing coupling with the wingtip surface. Additionally, the coils in any one set (transmitter or receiver) are axially offset and are kept adequately separated from each other. The system also comes equipped with a 50/60 Hz power line monitor which becomes particularly useful in identifying cultural interference when surveying in urban settings. Other ancillary equipment includes radar and laser altimeters, and a real-time digital video recording system.

Other geophysical survey methods may also be employed simultaneously with EM data acquisition. High resolution aeromagnetic data can be gathered in conjunction with this EM system. The cesium magnetometer sensor is mounted in a stinger attached to the tail of the aircraft. The Twin Otter can also be fitted with gamma ray detectors for radiometric surveying with a detector volume tailored to fit the survey program objectives. SGL uses **SGSpec** and Radiation Solutions Inc. (RSI) spectrometers, which are recognized as the most advanced airborne spectrometer systems available. Gravity (**AIRGrav**) and methane detection are also compatible with this system configuration.

AIRBORNE INSTRUMENTS

Electromagnetic System	**Frequencies** (Hz)	925	3,005	11,962	27,933
	Tx-Rx coil spacing (m)	21.35	21.35	21.38	21.38
Supplementary Systems	**Power line monitor** (50/60 Hz) **Sferics monitor**				
Data Acquisition System	**Sander Geophysics - SGDAS** airborne computer Capable of recording an unlimited number of channels at variable intervals, and digital scrolling chart display of the data. Data are 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.				
Video Imaging System	**Sander Geophysics - SGDIS** digital video				

		Resolution (m)	Calibrated to	Range (m)
Laser Altimeter	Riegl LD90-3300VHS-FLP	0.25	<1%	0 to 10,000 (33,000 ft)
Radar Altimeter	Collins	0.5	1%	0 to 760 (2,500 ft)
Barometric Altimeter	Honeywell TJE	2.0	+/- 4 m	0 to 10,000 (33,000 ft)

AVAILABLE INSTRUMENTS FOR SIMULTANEOUS MULTIDISCIPLINARY SURVEYS

MAGNETICS	
Sensor	**Geometrics** Strap-down, optically pumped, cesium split beam Sensitivity: 0.005 nT Sensor noise level: < 0.02 nT Sampling rate: 10 Hz
Compensator	**Sander Geophysics - AIRComp** real-time digital compensation Range: 20,000 to 200,000 nT Resolution: 0.001 nT Sampling rate: 160 Hz
RADIOMETRICS	
Spectrometer	**SGSpec** or **Radiation Solutions RS-500**
Detector Volume	16.8 to 50.4 litres of downward looking crystals 4.2 to 12.6 litres of upward looking crystals
GRAVITY	
Gravimeter	**Sander Geophysics - AIRGrav**, Airborne Inertially Referenced Gravimeter
METHANE	
Analyzer	**Sander Geophysics - SGMethane**, methane gas sensing system

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