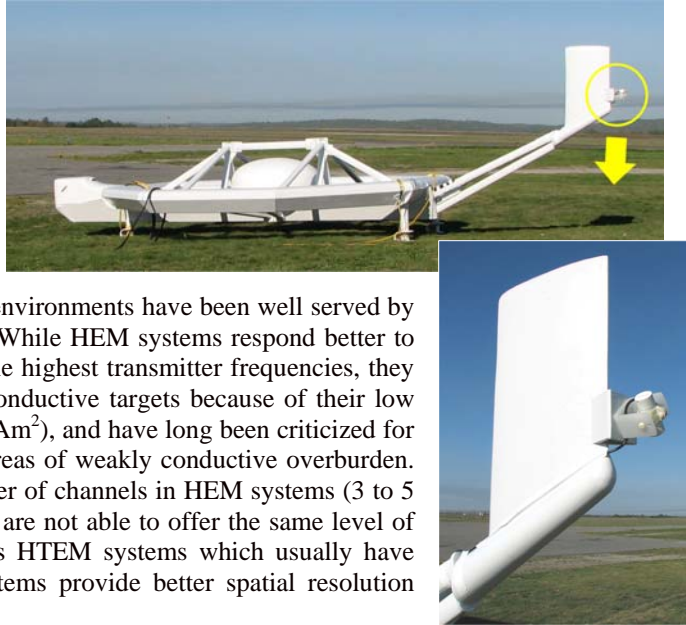


Aeroquest Announces the Upgraded AeroTEM System

Aeroquest has been actively improving the AeroTEM helicopter time-domain EM (HTEM) system for use in the search for weakly conductive targets that may have an associated but very weak magnetic signature. Such geophysical targets have been described in the search for hydrothermal gold deposits and kimberlite pipes. Historically these environments have been well served by frequency domain (HEM) systems. While HEM systems respond better to very weakly conductive targets at the highest transmitter frequencies, they have a limited ability to energize conductive targets because of their low relative transmitter power (e.g. 400 Am²), and have long been criticized for producing too many anomalies in areas of weakly conductive overburden. In addition, the relatively low number of channels in HEM systems (3 to 5 coplanar coil pairs) means that they are not able to offer the same level of diagnostic conductor information as HTEM systems which usually have over 15 data channels. HTEM systems provide better spatial resolution than HEM systems.



Detection of Weak Conductors

The normal AeroTEM configuration measures 128 samples during each half cycle of a transmitted pulse. For a base frequency of 150 Hz this translates into a sample time of approximately 26 μ s. EM systems do not shut off instantaneously and a finite amount of time is required before useful measurements can be made. However, it is in the time immediately after the transmitter is turned off that sensitivity to weak conductors is achieved. For example, the first channel in the VTEM system offered by Geotech has a 130 μ s delay after transmitter turn-off, while AeroTEM's first channel is at approximately 50 μ s. The MegaTEM and GeoTEM fixed-wing systems, offered by Fugro Airborne Surveys, have a delay of about 100 microseconds. As a result, the AeroTEM system is the most sensitive airborne time domain system to weak conductors.

Recently, the AeroTEM system was modified to measure 256 samples, or every 13 microseconds. Further refinement of the processing software has allowed the first off-time sample (13 microseconds after turn-off) to be used for the detection of very weak conductors. Figure 1 shows the early off-time profiles of the modified AeroTEM system over a very weak conductor. It is now possible to detect targets with AeroTEM having time constants of only a few microseconds and to depths that are greater than that of HEM systems. While HEM systems offer only a single mid- and high-frequency, AeroTEM can now offer several channels at the 13 μ s gate width which have a similar frequency content to the higher frequencies of the HEM systems.

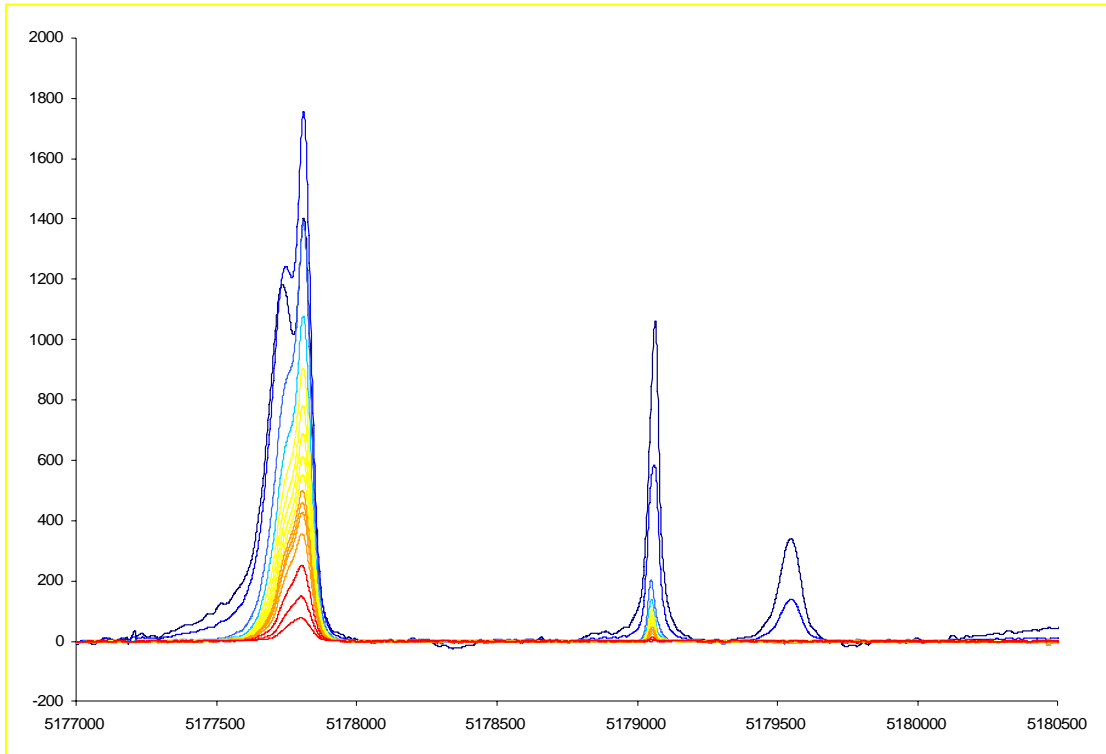


Figure 1. AeroTEM off-time profiles over a series of conductors near Sudbury Ontario show how the modified AeroTEM system responds well over a very wide range of conductance values. The southern conductor (Ni-Cu sulphide) is very conductive (over 100 S), while the central conductor (Cu-PGE rich sulphide) is moderately conductive (about 1 S). The northernmost conductor is only very weakly conductive (less than 0.05 S) and would not be detected with other helicopter time domain EM systems.

Detection of Weak Magnetic Features

The low power of HEM systems allows measurement of the Earth's magnetic field using a magnetometer sensor mounted directly onto the HEM platform. Until recently this has not been possible with HTEM systems, because of the large magnetic fields produced by the high moment transmitters (e.g. 40,000 Am² and greater). HTEM systems must have a separate housing for the magnetometer, located well above the EM system on the tow cable (e.g. this has been 17 m in the case of AeroTEM). Given the nominal ground clearance for HTEM systems of 30 m, the magnetometer is typically 45 m or more above the Earth's surface where subtle magnetic features, such as gold-bearing fractures, may go undetected.

All AeroTEM systems (II, III and IV) are now being outfitted with two magnetometers, one located on the tow cable approximately 47 m above ground and a second sensor mounted directly onto the platform at 30 m. This provides for two independent measurements of the total magnetic field, and for a measured vertical gradient with a sensor separation of about 16 m. Typical vertical magnetic gradiometers have a vertical separation of only a few meters. When deployed on a fixed-wing platform the measurements are made at distances of 90 m and more above the Earth's surface. At these heights, the gradient can be very small and can fall near or within the practical noise limits of the sensor technology.

The results of a recent AeroTEM survey are shown in Figure 2 for both magnetometer sensors. The vertical measured gradient for one anomaly on the profile is less than 0.4 nT/m, but given the large separation between the sensors, the measured difference is more than 6 nT, well within the sensitivity of the sensor technology. The measured vertical gradient for subtle anomalies has 3 to 4 times the

signal and about half of the noise when compared to the calculated vertical gradient for the higher sensor. In other words, by placing the magnetometer on the bird we have improved the sensitivity level to weak magnetic features by almost an order of magnitude.

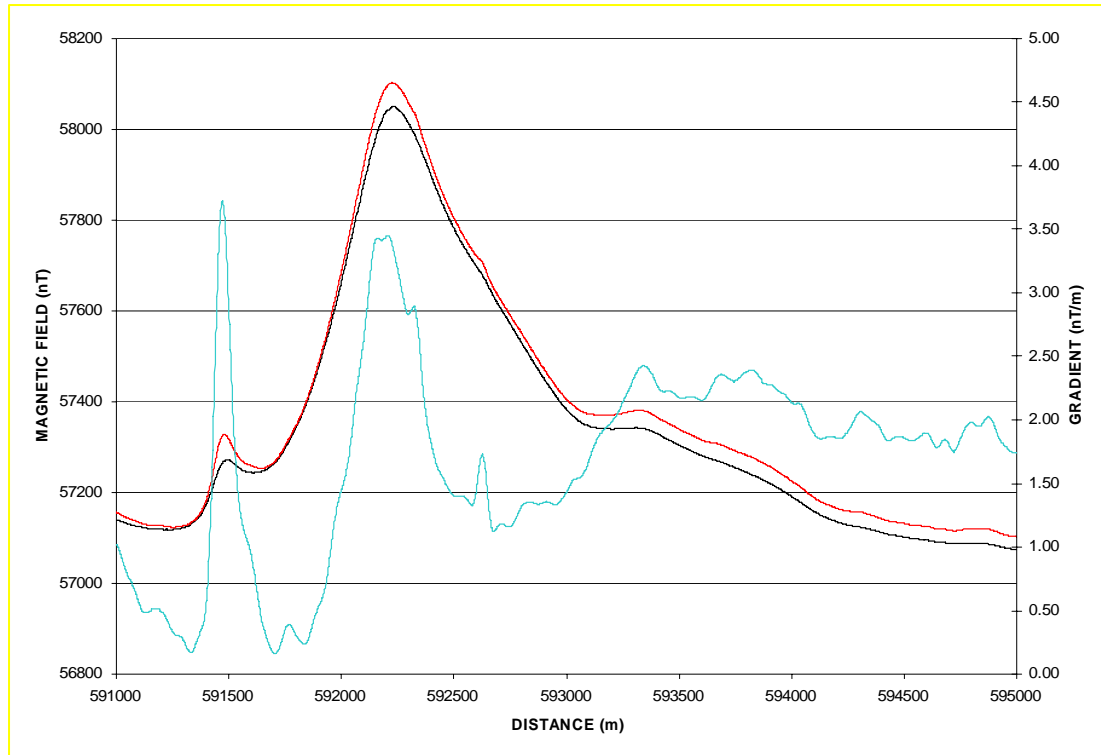


Figure 2. Measurement of the total magnetic field for a sensor mounted on the tow cable (black) and a sensor mounted on the EM bird (red) for the AeroTEM system. The vertical gradient (measured) is shown in light blue. Note the subtle magnetic response between 592500 and 593000, that, while present in the calculated vertical derivative of the conventional magnetometer (on tow cable) is very near the noise level (0.4 nT/m peak response above background).

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