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SkyTEM Helicopter EM

Advanced helicopter time-domain electromagnetic technology for high-resolution subsurface imaging

Mining, Infrastructure, Environment

SkyTEM's advanced electronics deliver reliable, accurately-calibrated TEM data. The unique combination of high and low transmitter moments yields unparalleled spatial and depth resolution.

SkyTEM is a time-domain electromagnetic system, capable of operating in a dual transmitter mode:

- Low moment mode where low current, high base frequency and fast switch off provide early time data for shallow imaging with very high spatial and depth resolution;
- High moment mode, where a higher current and lower base frequency provide high quality late time data for deep imaging and penetration through conductive cover.

The exact sequencing of high and low transmitter moment modes can be digitally programmed to trade off vertical versus horizontal resolution for specific applications. The system can thus be used in either the low or high moment modes, or in a combined (dual) mode where the high and low moment acquisition is interleaved.

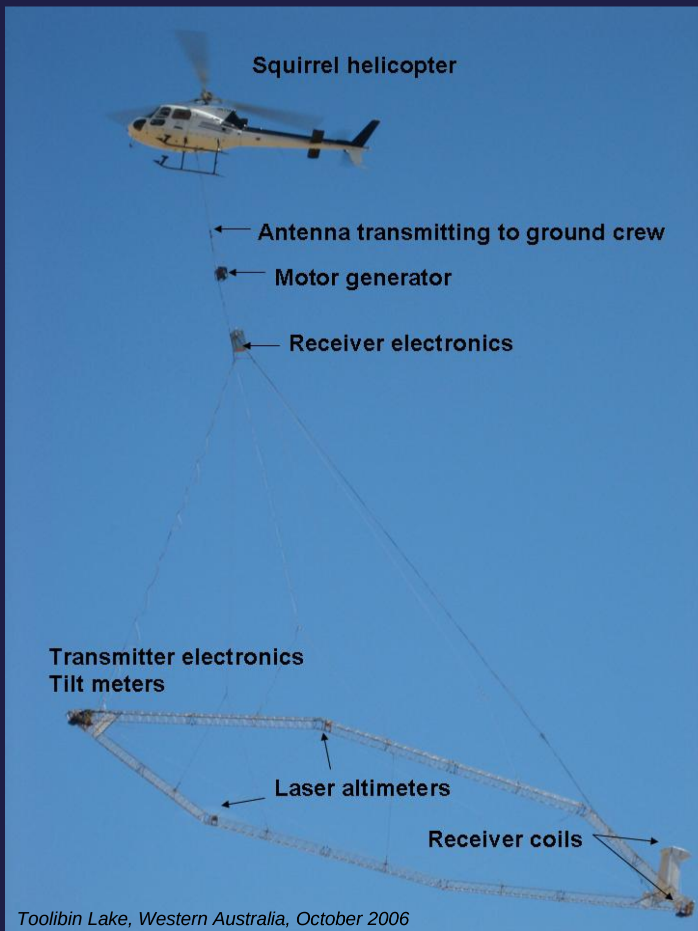
Specifications

Low moment

- Peak moment (314 m^2 Tx loop): 12,500 nAI
- Repetition frequency: 222.22 Hz (typical)
- Tx pulse width: 0.8 ms
- Switch off: 4 μs.
- Typical current: 40 A
- Delay times: 11.8 μs to 1.14 ms (20 channels)

High moment

- Peak moment (314 m^2 Tx loop): 113,000 nAI
- Repetition frequency: 25 Hz
- Tx pulse width: 10 ms
- Switch off: 31 microseconds.
- Typical current: 90A
- Delay times: 47 μs to 8.8 ms (24 channels)



Toolibin Lake, Western Australia, October 2006

- Both vertical and horizontal components of dB/dt are measured
- Calibrated system with minimal bias or drift. Repeated high altitude flights to check drift are not required
- Tx terrain clearance: 30 m (nominal)
- Flying speed 80 km/hr (typical) but can range from 20—100 km/hr
- Easily transported with fast assembly (< 1 day)

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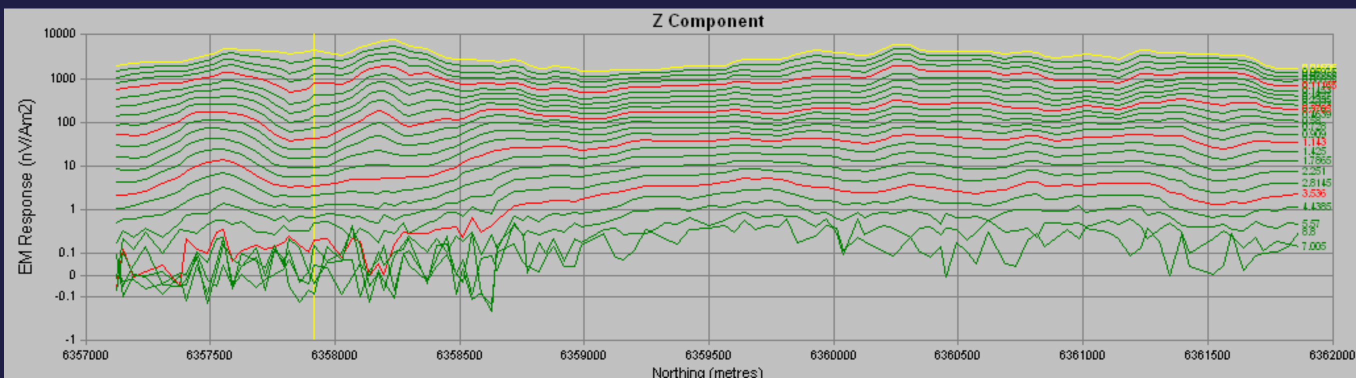
These figures show raw SkyTEM data from a repeated flight line at Toolibin Lake, Western Australia. The flight line is 5 km long, and both of the repeats shown were flown in the same direction. Average flying speed was 80 km/hr.

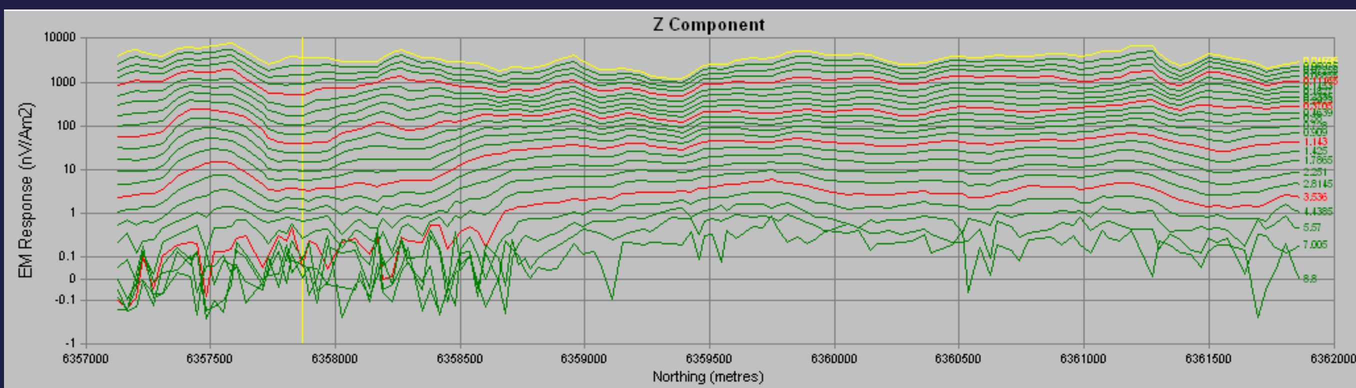
The data shown were acquired in the high transmitter moment mode, at delay times ranging from 47 microseconds to 8.8 milliseconds. Each reading represents a stack of 64 transients. No other processing or filtering has been performed. Data at later delay channels are highly repeatable. Small differences at the earliest delay times are due to variations in survey altitude between the two flights.

The strong SkyTEM response in the central part of the line is due to highly saline groundwaters within the regolith. Previous airborne and ground EM surveys at Toolibin have indicated ground conductivities of up to 700 mS/m. Regolith thickness in the Toolibin area ranges from 0—60 m, with a typical value of ~25 m.

Repeat 1



Repeat 2



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SkyTEM - LCI Inversion

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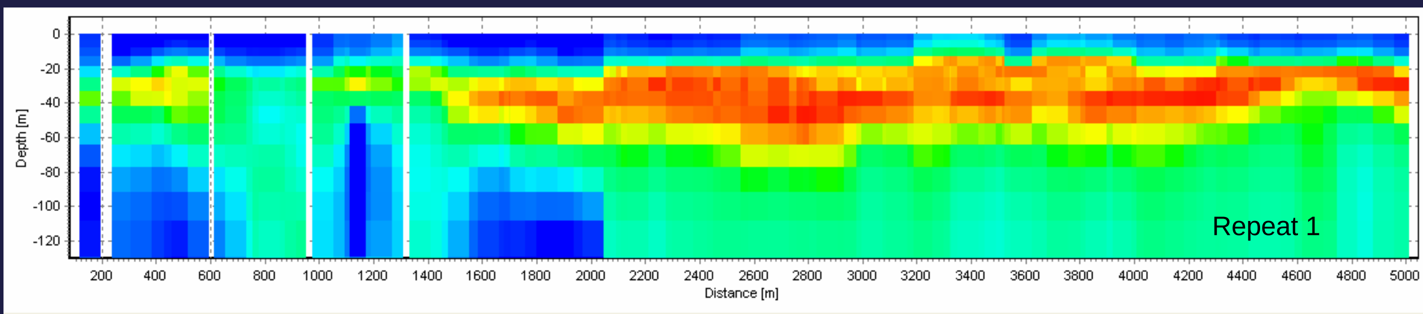
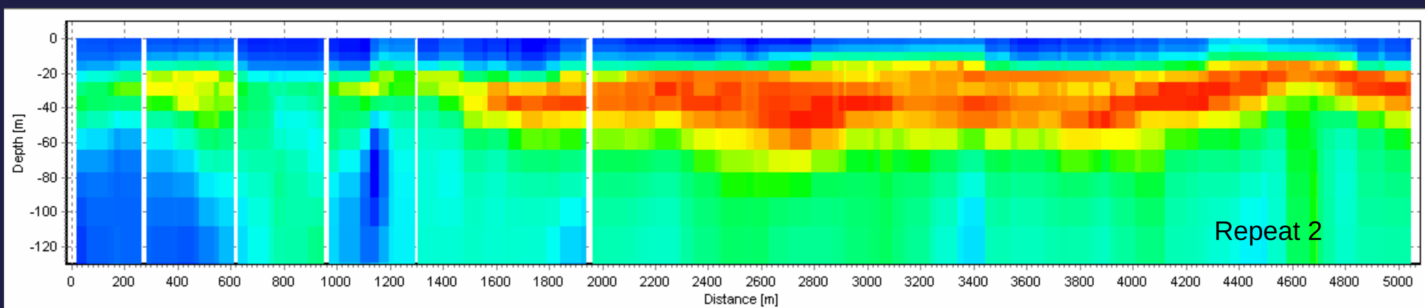
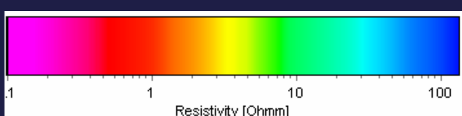
These figures show inversions of SkyTEM data from the repeat line shown on the previous page. The inversion was performed using the Aarhus Workbench software, using a smooth 15-layered model. Inversion was carried out on both the high and low moment data, using the Laterally-Constrained Inversion (LCI) method developed at the University of Aarhus. The principle behind 1D-LCI is to simultaneously invert several adjacent readings using 1D models which are constrained laterally on a number of chosen model parameters as layer resistivities, layer thickness and/or layer depths. The outcome of this scheme is a smoothed pseudo 2D section with sharp layer boundaries. 1D-LCI has shown a significant improvement in model resolution especially in the deepest part of the models i.e. at late times, when data can be heavily influenced by background noise.

The raw data were spatially averaged prior to inversion in order to improve the late-time signal-to-noise ratio. Averaging and rejection of noisy data and anomalies due to cultural sources are performed automatically by the Workbench software.

The inversion models from Toolibin show very good repeatability, particularly within the upper 100 m. Gaps in the model sections correspond to locations where measurements were deliberately made with the transmitter switched off. These noise measurements were made for testing purposes and are not conducted as frequently during routine production.







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