Major Recent Improvements to Airborne Transient Pulse Surveys for Hydrocarbon Exploration

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Authors LeSchack and Jackson presented "Airborne Measurement of Transient Pulses Locates Hydrocarbon Reservoirs" at the AAPG Annual Convention, April 9-12, 2006; Houston, Texas. That described a reliable, cost-effective, environmentally friendly remote sensing tool for finding oil and gas both onshore and offshore. Recently, major improvements have been made to automate the efficient airborne collection of data as well as to make estimates of the depth at which reservoirs would likely be discovered. Now referred to by us as the "Audio Frequency Electromagnetic Survey" (A-EM survey), it is based in part on the AFMAG airborne survey discussed by S.H. Ward. Lightning activity worldwide contributes transient pulses, and combined with streaming potentials and oscillating magnetic fields associated with hydrocarbon-related Redox activity, a measureable source of electromagnetic energy radiating to the surface can be detected from low-flying aircraft. The frequency of these emissions radiating from the earth can be related to the depth of subsurface hydrocarbons.

Using an E-field antenna mounted in a low-flying light plane, the newly developed computer software divides a frequency spectrum of 200-2200 Hz into 11 discrete frequency bands and records the segmented data in a spreadsheet format. The maximum signal amplitude of each frequency band is recorded as a data column, including a "sum" data column. The data are averaged and recorded once a second, along with the GPS coordinates, UT Time, Date and Survey Time, all simultaneously with the data columns. The file can be sent from the field via E-Mail and imported directly into mapping programs or spreadsheets for filtering before mapping. Various averaging functions such as derivative, square root or statistical noise filtering algorithms can be applied to enhance the mapping of the data.

To date, some 50 surveys have been flown in North America, and 30 more in New Zealand and Australia; as well, a major offshore survey over the North Sea was flown. Numerous anomalies have been found, and subsequently drilled, resulting in successful producers. One survey was flown over one of author LeSchack's Alberta prospects; it was recently drilled and oil was discovered as predicted.

Our statistics point to a valuable reconnaissance tool for industry, and certainly for governmental national resource surveys.