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tCSEM™ instrumentation in oil and gas exploration

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In recent years electromagnetic methods saw a strong revival in oils and gas exploration. The academic work of institutions like SCRIPPS or the University of Southampton, only to name two, triggered a quickly growing marine EM exploration industry. Magnetotellurics (MT) as well as controlled source electromagnetic (CSEM) measurements have proven to deliver very useful information to the oil and gas industry. The huge successes of CSEM in the marine environment has lead to renewed interest in EM land exploration. One such area of application is in the use of airborne EM for the detection of tar sands.

In the marine environment the typical CSEM measurement setup consists of receiver nodes that are deployed from a ship and sink independently to the ground and a transmitter dipole that transmits a single frequency while being towed close to the mud line. Interpretation is typically based on amplitude vs. offset and phase vs. offset sections. Although extremely successful in many cases, the method faces restrictions in certain environments. For example in shallow water, the signals are dominated by the so called air wave. In addition, data from close transmitter receiver offsets are difficult to use for interpretation.

A way to overcome these issues is through the use of the transient EM method where the measurements are made in the absence of the primary field. KMS-Technologies' transient CSEM (tCSEM™) technology allows one to separate the air wave from the subsurface signals and to gather useful data at much closer offsets.

After successful field trials using specially developed tCSEM™ nodal systems, KMS-Technologies now is developing a multi component ocean bottom cable (OBC) based tCSEM™ system. Benefits of OBC systems are much closer sensor spacing and better repeatability of sensor positioning, thus making the cable an ideal system for time lapse surveys.

The OBC consists of multi component remote acquisition units (RAUs) that are linked via a telemetry cable. All data is sent in real time to a central data collection unit located in a buoy. Here the data is checked for integrity and other quality control parameters. Several OBCs, each using a buoy of its own, can be used simultaneously to build an array. Radio links connect the buoys to the control ship and allow for real time user intervention.

A similar setup is used for permanent monitoring installation in a well. Combining the permanent installation of the well with the high position repeatability of the cable ultimately results in a reliable, high density time lapse EM system for production control.