

THE OILSEARCH TECHNOLOGY – AIRBORNE SURVEY TECHNIQUES FOR HYDROCARBON EXPLORATION IN DEEP WATER ENVIRONMENTS

Timothy R. Bodger, President, McPhar International and Chris Moir, Director, Oilsearch plc.



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McPhar International, under licence from Oilsearch plc of the UK, is proud to present unique and exclusive airborne surveying technology for hydrocarbon exploration in both shallow and deepwater environments.



This multi-sensor technology includes:-

SEEPFINDER - tracks the spread of sea surface hydrocarbon films from their emergence points on the sea bed down to the dissolution of the films due to wind and wave action.

GRAVEX - light weight, very-high resolution compact airborne gravity detection system.

AEROMAGNETIC - high-sensitivity system delivering magnetic data with a resolution of 1 pT (.001 nT).

The detection of oil seepage has often given the oil exploration industry the first clues to sub-surface and sub-sea oil accumulations – some authorities claim that 95% of all discoveries were made because of seepage in one form or another.

SEEPFINDER was developed in 1990. In close collaboration with oil exploration companies, it has been refined to an optimum state and has achieved impressive results in selected oil regions around the world.

SEEPFINDER adds a new dimension to offshore oil exploration and provides the only reliable, high sensitivity offshore oil seep detection system. Originally a 7-channel system, **SEEPFINDER** now features 14-channels. Mounted in a light aircraft, and steered by satellite GPS navigation, **SEEPFINDER** records the presence of thin molecular oil films on the surface of the sea which have risen via geological faults to the sea bed, often driven by gas pressure.



Figure 1: The SEEPFINDER System

Over 350,000 kilometres of survey data has been acquired by **SEEPFINDER** systems worldwide, for a client base of over 30 of the world's major oil companies. Surveys have been performed in Africa, Europe, USA, Asia and Australasia. Over 140,000 line kilometres of data has been recorded in the UKCS and Europe in recent years, mainly in association with licence rounds. Project sizes have varied from large, multi client surveys in frontier areas where little or no geophysical data existed, down to small, highly detailed proprietary surveys, often associated with drilling or seabed coring.

Survey results are presented as contour and analysis maps, showing light (L), medium (M) and heavy (H) oil types and a composite map of all seepage signatures. While **SEEPFINDER** data is not directly calibrated in API units, an approximate assignment would give light > 35°, mid 25° to 35°, and heavy below 25°.

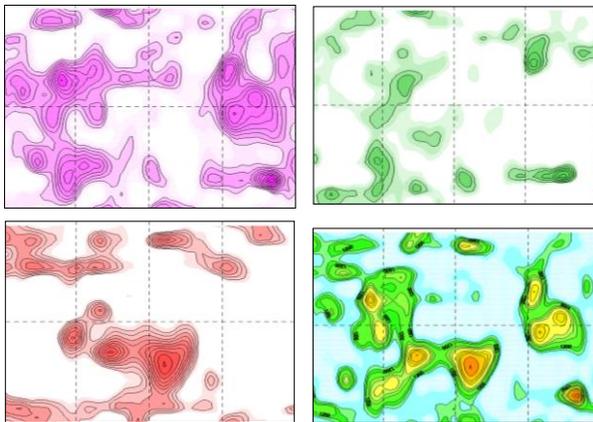


Figure 2 – SEEPFINDER - examples of light, mid, heavy analysis maps and composite maps

The amplitudes of the analysis maps are adjusted to give approximately the same colour balance for each map, whereas the composite map shows the true relationship between the different regions and/or types of seepage.

GRAVEX is a system of individual gravity sensors mounted in an aircraft in a configuration that allows for a greatly enhanced processing of gravity data.

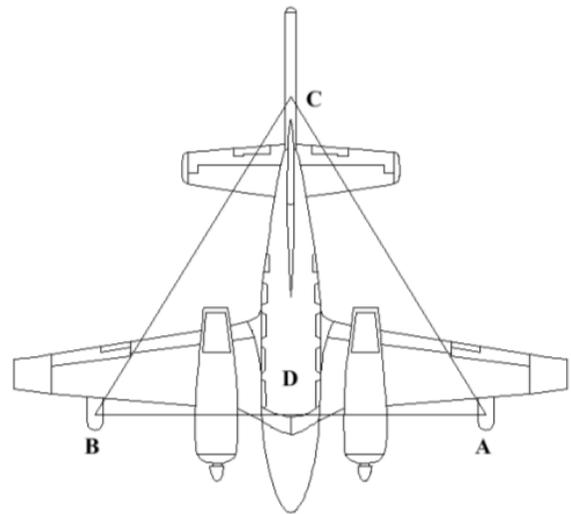


Figure 3 - The GRAVEX configuration on the aircraft. Each wing pod and the stinger carry a single miniature, temperature and axis-stabilised gravity sensor (ABC), together with one at the aircraft centre of gravity (D), acting as a reference. Typical dimensions of the gradient triangle formed is 10 metres per side.

As with many good ideas, **GRAVEX** is a unique combination of experience, new and existing technologies, all partnered with a new method for using them, with the whole concept now protected by patent.

GRAVEX is a multi-sensor approach to the measurement of gravity gradiometry, applied over a much larger baseline - typically approaching the dimensions of the aircraft hosting the system. The survey aircraft is fitted with wing pods, aerodynamic wingtips and a tail "stinger" housing a high-sensitivity cesium magnetometer. Each wing pod and the stinger house a single, temperature and axis-stabilised, miniature gravity sensor, together with one at the aircraft centre of gravity, acting as a reference. Typical dimension of the gradient triangle formed is 10 metres per side. The triangle of sensor data is compensated for aircraft movement by a laser system and then presented as a gradient vector and a slope angle.

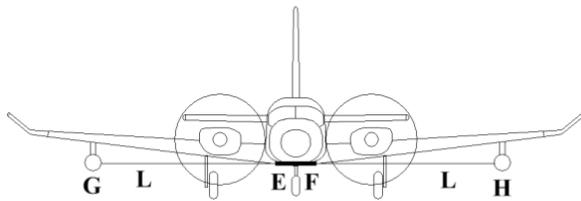


Figure 4 – GRAVEX ensures synchronisation of the wingtip sensors by a laser measurement system (EFGH) which accurately eliminates wing flap errors (measured to within microns) in the gravity signals from the sensors. The long baseline provides a >200 times more accurate gradient.



Figure 5 – Piper PA-31 Navajo survey aircraft. This aircraft is equipped with long-range fuel tanks and has a flight duration in excess of 7 hours

Sensor sample rate is 1 KHz. Even when smoothed times 10, the delivered data rate is 100 points per second. At 140 knots (260 km/hr), this is better than 1 metre along line resolution. When flown on a close line spacing the adjacent triangulation points from each line can be directly linked, providing a high resolution geodesic envelope which is lightly smoothed to create the gradient map.

The Oilsearch Technologies are fully integrated into an airborne survey platform; with minimal mobilisation and setup times. Readable data output based on rapid processing allows for survey area adjustments to maximise collection of data of interest during a project.

The Oilsearch Technologies offer a fast, flexible solution to offshore exploration. The unique combination of technologies allows detection of offshore seepage and structures with the ability to follow structural trends through the transition zone and onshore. Lightweight and compact equipment gives maximum fuel performance allowing up to 1,200 Km of data to be collected per day. Fast data processing times providing a fully integrated dataset gives clear results in a format that can be easily used to tailor additional exploration activities.

The Oilsearch Technologies provide the first real indication of oil before the drill bit in frontier offshore exploration, saving millions of dollars from your exploration budget.