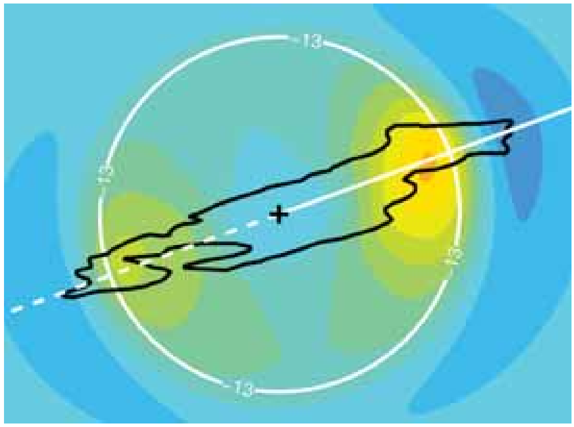
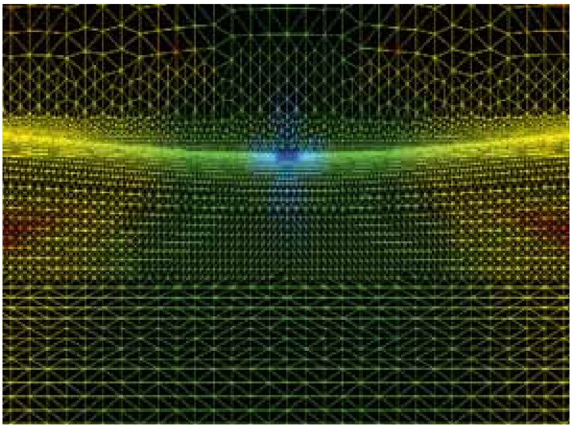
OFFSHORE HYDROCARBON MAPPING

OHMVision





OHMVision

Minimising exploration risk
Enabling powerful CSEM analysis and interpretation
Delivering compelling and informing results

www.ohmsurveys.com/OHMVision

OHMVision

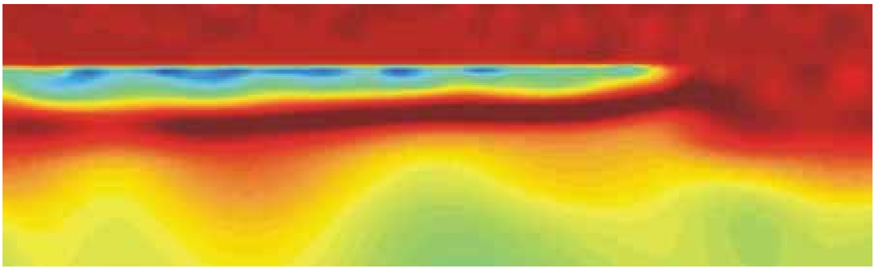
OHMVision – overview

OHMVision is the oil and gas exploration industry's leading interpretation and analysis software package for the processing, imaging, modelling and aiding the interpretation of a range of CSEM and other geophysical data, such as magneto-telluric (MT) and seismic.

OHMVision has been developed over the last 10 years by OHM's research and development staff and delivers unrivalled capabilities to process and analyse electromagnetic and other geophysical data – offering a more valuable final interpretation, facilitating informed drilling decisions.

OHM believe that exploration risk can be significantly reduced by applying the highest technology possible to processing and interpreting CSEM data – OHMVision makes this possible.

Right > Example of Joint CSEM/MT inversion (JEM)

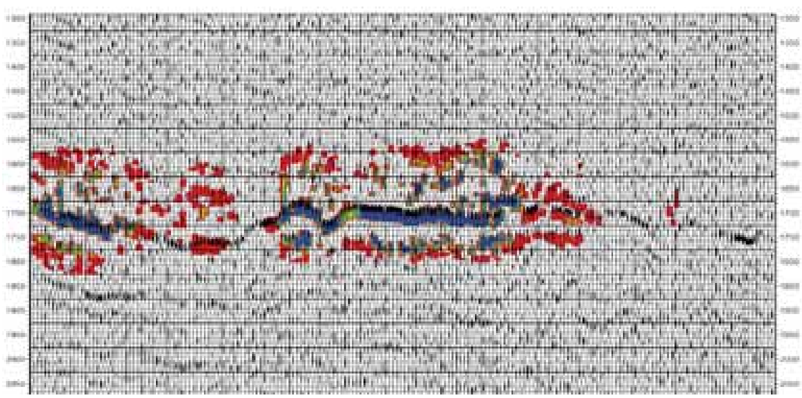


World class technology and personnel

OHM have assembled a world leading team of CSEM technical experts unmatched in any other organisation. Over a ten year period, they have conducted leading edge research into the physics which govern the propagation of electromagnetic signals in the earth. The algorithms and workflows embedded in the OHMVision software package result directly from this research and understanding. OHM continues to invest heavily in research in this field and advanced tools and workflows are being continually released.

OHM continually consults with clients to ensure this offering remains at, and continues to push, the very leading edge of the CSEM technological boundary.

Right > Example of Gas saturation determination from CSEM + seismic data



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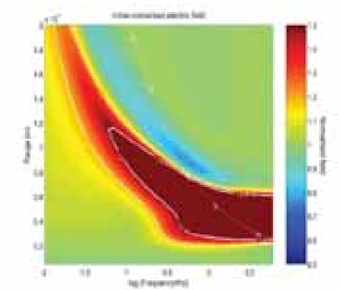
Pre-survey modelling, advanced survey design and processing

Prior to executing any offshore surveys, it is important to understand the sensitivity of anticipated subsurface structures to CSEM signals – this is the first part of any survey process and dialogue with our clients; this allows surveys to be carried out with the optimum parameters to deliver a compelling result.

1D Feasibility modelling

A rapid sensitivity analysis in order to screen prospect portfolios for targets within the operational envelope of a CSEM survey and to identify optimum survey parameters.

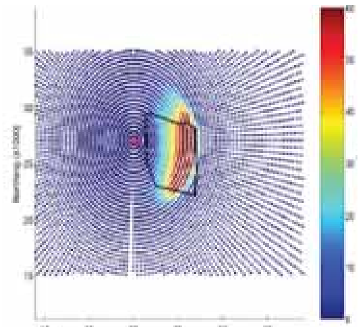
The modelling utilises OHM proprietary algorithms based on Maxwell's equations. The software runs under Linux on a single processor workstation; run times are of the order of minutes.



3D fast track forward modelling (OHM3D)

3D modelling correctly accounts for many of the approximations inherent in the 1D modelling process and gives a significantly more precise view of the likely response of the subsurface.

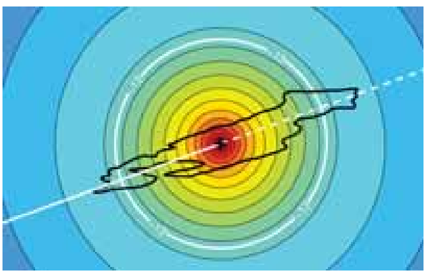
This proprietary OHM software is designed to provide a rapid, cost effective solution for predicting the 3D response of a subsurface feature.



Advanced 3D modelling (OHM3D Advanced)

For extremely complex subsurface problems, or when the highest accuracy in predicting EM response is required, a full 3D response to a fully 3D model of the subsurface feature and background needs to be calculated.

Bathymetry and geo-electric boundaries are accurately mapped into the 3D model, directly importing surfaces from seismic workstations.



Processing module

This module is concerned with the processing and QC of the raw survey dataset. Electromagnetic time series data taken straight from the receiver is edited, integrated with positioning information, transformed into the frequency domain and displayed in various forms ready for advanced analysis.

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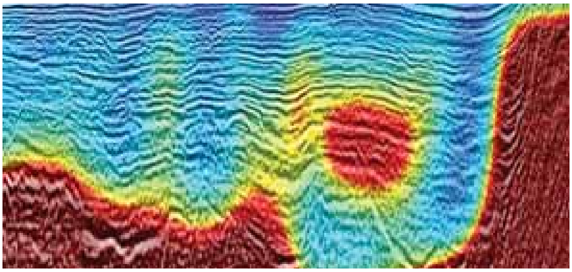
Imaging and inversion

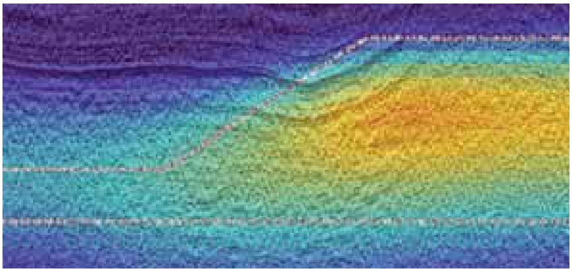
The goal of all our processing and interpretation efforts is to convert the raw electromagnetic data we collect into meaningful, decision-ready, information rich, images that can be easily incorporated into existing E&P workflows to decrease risk by improving the understanding of subsurface properties.

Highlighted here are three of the many imaging and inversion modules that form this element of OHMVision – for further information on all modules contained in OHMVision, please refer to: www.ohmsurveys.com/OHMVision

Constrained inversion (INV2D Prej)

An advanced constrained inversion routine which allows the user to prejudice an inversion result towards a structure derived from additional data – often seismic data. This can often result in capturing the vertical resolution of seismic data and transferring it to the CSEM result. This frequently results in sharper images of resistive bodies and may lead to an increase in accuracy of depth to the resistor.





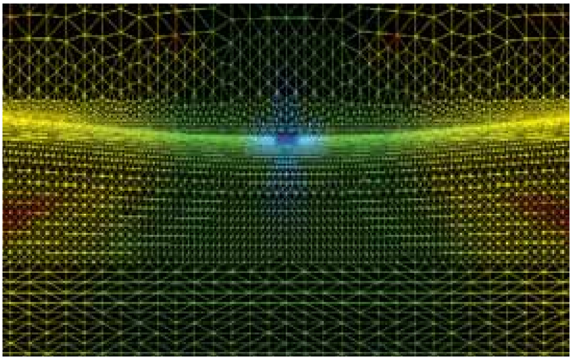
Joint CSEM/MT inversion (JEM)

In flood basalt and salt provinces, seismic surveys can often provide only limited information below the top of these bodies. A combination of CSEM and Magneto Telluric techniques provides a powerful way to image this region: CSEM data are primarily sensitive to the salt/basalt and region above the salt/basalt, whilst the MT data are sensitive to conductive underlying sediments and any resistive basement which may be present.

Seafloor topography inversion (INV2DSFT)

Marked bathymetric variations along CSEM profiles can create significant effects on CSEM data which, unless adequately processed, can completely obscure the response of underlying resistive structure.

INV2DSFT performs a calculation of the source wave field and the receiver wave field on a complex adaptive grid which fully describes the seafloor topography. This allows an accurate forward prediction of the CSEM signal to be projected into the 2.5D inversion engine enabling the inversion to solve for the correct subsurface structure.



There are many further modules that perform the advanced imaging and inversion within OHMVision, these include:

- **> 2.5D amplitude only inversion**
- **> Co-rendering EM with seismic**
- **> Amplitude and Phase inversion**
- **> Shallow water inversion**
- **> Diffusive E-field focusing**
- **> 3D Inversion**

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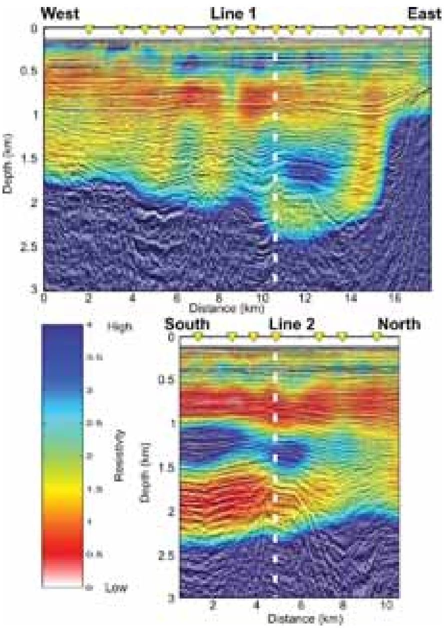
Interpretation

OHM's industry leading staff often work closely with clients for advanced interpretation of their CSEM and for integration of CSEM data with their existing data; delivering a further significant level of value.

For example, integration of CSEM data with seismic data for rock and fluid property determination is particularly in demand.

As each project is unique, OHM will work with its clients to determine the desired project outcomes and to advise on the range of options that can be applied to datasets. A work plan is then developed for the project and is reviewed regularly to ensure that the optimum result will be delivered in the desired timeframe.

Case study – Falkland Islands, Prospect Ernest

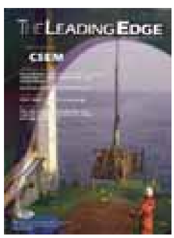


Above > Results of inversion of data from line 1 (top) and line 2 (bottom). The crossover point of the two lines is indicated by the white dashed line. There is a localized resistor consistent with the Ernest prospect on both lines.

Working on behalf of Rockhopper Exploration Plc, OHM acquired multiple CSEM surveys in the North Falklands Basin during early 2006, including one over Prospect Ernest.

OHMVision facilitated a highly successful survey process along with the subsequent processing and interpretation: Careful modelling survey design allowed high quality data to be collected in challenging conditions. The normalised field data were consistent with the pre-survey modelling results – changes in the basement structure were easily identifiable.

The advanced modelling results highlighted the complex basement structure. Discrete resistors were identified on both of the lines, and are consistent with the location of target structures mapped from seismic data. Co-rendering of the CSEM results with seismic data allowed direct comparison between the structures mapped by both methods. The discrete resistor is associated with a four way dip closure.



Case study as featured in SEG *The Leading Edge*, March 2007

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Front cover images:
(clockwise from top left):
Dr Zhijun Du of OHM, Example of gas saturation determination from CSEM & seismic, A receiver being deployed during a CSEM survey, Example of seafloor topography inversion.

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