

# The Rapid Adoption of Seabed Logging

Game-changing seabed-logging technology is revolutionising exploration performance. Ken Feather, Vice President, Marketing, EMGS, talks to *Scandinavian Oil & Gas Magazine* about seabed logging, a technology that has been rapidly adopted, despite being a brand new exploration concept.

Seabed logging is an innovative electromagnetic (EM) method of locating offshore hydrocarbon reservoirs. Its first commercial application was only in November 2002, but since then EMGS – the Norwegian company credited with inventing the technique – has conducted more than 250 surveys for almost 40 customers in various parts of the world. This is an unusually good take-up rate for a game-changing technology. And the technology has been particularly well received by several major and national oil companies, including BP, Chevron, Eni, ONGC, Petrobras, Petronas, Reliance, Shell, Statoil and Woodside.

## Raising Drilling Success Rates

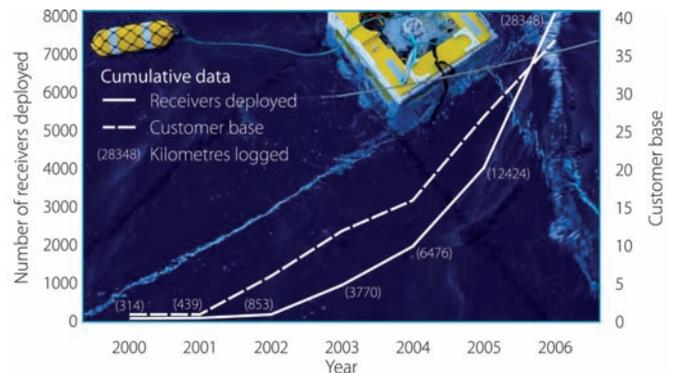
“Drilling success rates have historically been only around one in four, but seabed logging has genuine game-changing credentials and is setting a new standard,” says Feather. “We have performed over 250 surveys. Not all our customers share their drilling results with us, but seabed logging has correctly predicted the reservoir fluids in more than 90 percent of the 43 cases where we have been able to compare our survey results with their reservoir evaluations.”

For all the benefits that successful game-changing technologies generate, history shows that they often have a relatively difficult time to

start with. In fact, the user community tends to reject them, sometimes out of ignorance, sometimes out of fear, but mostly because they generally upset the status quo. They are often, in the best sense of the word, disruptive technologies.

Seabed logging does not fit the usual game-changer pattern, as it has been embraced very positively by the industry from the beginning. In Feather’s opinion, there are three reasons for this. First, the world has been using oil and gas faster than the industry has been identifying new reserves for several years, so there is a compelling need to improve the industry’s hydrocarbon-finding record. Second, operators are comfortable with the basic principles behind the technique. Borehole logging that uses EM methods to identify resistive anomalies, and therefore hydrocarbon accumulations, has been around for 75 years and is well accepted. What EMGS has done, however, is to overcome the massive problem of making reliable resistivity measurements remotely, that is, from the seabed. And third, seabed logging is a perfect partner for seismic surveying, the industry’s staple exploration technique.

The compatibility of seabed logging with seismic surveying has probably been the biggest factor in capturing the interest of the



**Meeting demand: EMGS has now performed over 250 commercial surveys, and deployed over 8,000 receivers, for almost 40 leading oil companies. The company has used this experience to take EM receiver technology to new levels. Advances such as increasing the receivers’ dynamic range and developing ultra-low-noise electronics have extended water- and target-depth capabilities.**

exploration companies. That seabed logging does not provide a silver bullet but rather a strong fit with more established techniques has perhaps, unsurprisingly, worked in its favour.

Seismic surveying is very valuable, particularly with recent advances in 3D acquisition and imaging techniques. However, seismic surveying, although it can identify structures that might be expected to contain hydrocarbons, has the drawback that it is practically blind to the fluids contained in the formation. This explains why roughly three out of four prospects highlighted by traditional means turn out to be dry. No wonder, then, that using seabed logging, which responds to the fluids in the rock, to confirm or discount

prospects identified by seismic surveying has become so popular, and so quickly. It is worth noting that, to EMGS’ knowledge, the seabed-logging predictions have been confirmed in more than 90 percent of cases where well data have subsequently become available.

Seabed logging is clearly making a significant impact on the oil and gas exploration business; currently the technique is being evaluated by the industry for more advanced applications. “We have seen excellent results when using seabed logging for so-called target-oriented surveys. Now, oil companies are routinely using seabed logging in scanning mode to explore in frontier regions – before they invest in seismic programmes,” says Feather.

**Scanning Frontier and Mature Basins**

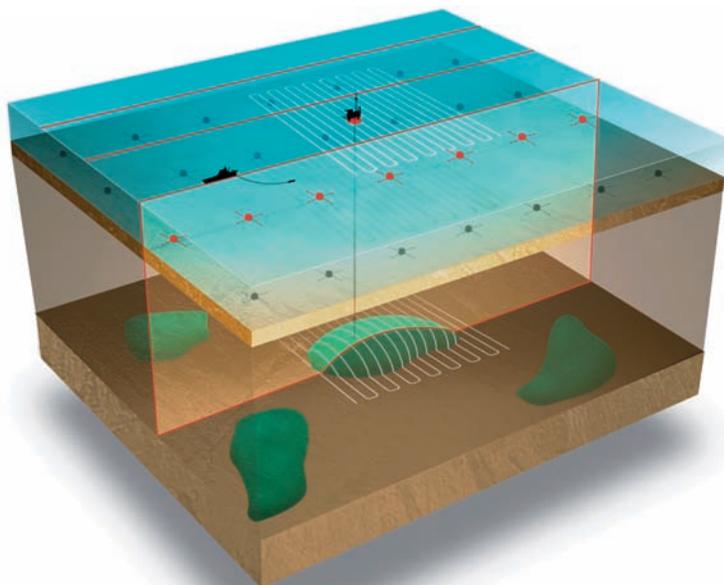
The rapid increase in demand for oil and gas, coupled with more difficult reserves replacement in established hydrocarbon provinces, is forcing exploration into deeper water and remote, often inhospitable, unexplored parts of the world – frontier regions. Frontier exploration inevitably means greater risks, increased costs and limited availability of the specialist equipment needed for the task. And, the costs of field development and operation will be far higher than in the established provinces where there is existing oil and gas production infrastructure. For these reasons, there is a real need to find oil quickly and efficiently in frontier regions – and in large quantities.

Leading oil companies are turning to seabed logging to help them out, as Feather explains: “During several seabed-logging exercises over areas previously seismically surveyed, resistive anomalies were picked up in locations where, significantly, analysis of the seismic data had drawn a blank. This has led some oil companies to re-evaluate their approach to seabed logging and to consider its use as a first-look tool in frontier areas. The idea is to use the technique to rapidly generate leads in areas

where large (commercial) hydrocarbon accumulations are most likely to be found. By this means, companies will be able to focus their investment in higher-density seabed-logging surveys and seismic acquisition and, ultimately, drilling on areas that offer the best returns.”

EMGS has already adapted and optimised the seabed-logging process for use over sparse grids in what the company is calling scanning mode. When the objective is simply to detect large anomalies, the density of the EM source lines and of the receivers may be reduced, although the company has developed azimuthal techniques that can identify anomalies that lie between survey lines. And, because preliminary processing of seabed-logging data is also very fast, it is possible to quickly scan considerable areas for large hydrocarbon accumulations, which is very useful in frontier areas such as the Barents Sea, where the weather windows are often very tight.

Naturally, the sparse coverage does not permit the accurate characterisation of any finds. However, as a prelude to more targeted seabed-logging and seismic surveys, the scanning process holds enormous potential – and not just for frontier areas. Scanning can equally be



***Focused exploration: Scanning data can be acquired using sparse grid patterns and evaluated quickly to identify, confirm, rank or exclude prospects. More detailed 2D or 3D seabed-logging surveys can then be designed and acquired to investigate prospects while the vessel is in the survey area, and the processed and interpreted data can be used to optimise well placement.***

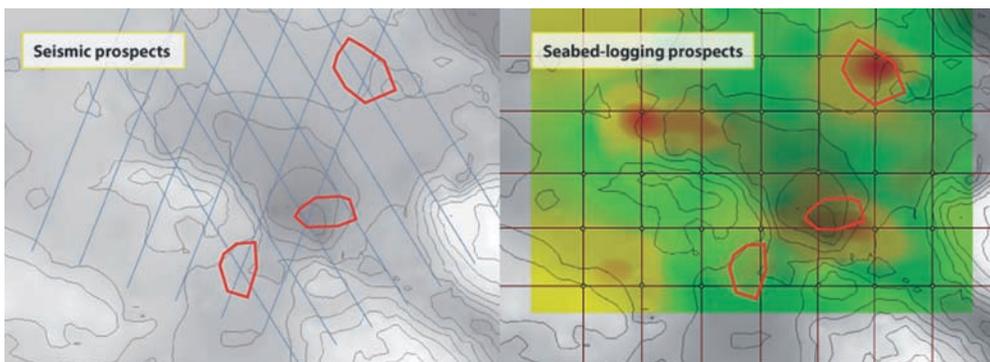
applied to mature basins, during the life of an asset, for revealing potential satellite fields or missed opportunities as a final look before assets are abandoned or relinquished.

The scanning data can be evaluated quickly, and detailed infill surveys to investigate the identified resistive anomalies can then be designed and acquired before the vessel leaves the survey area. This

fast iterative approach is accelerating prospect delivery, reducing the time to first oil, cutting exploration costs and eliminating extensive exploration in non-hydrocarbon bearing areas.

Now, smarter and more efficient EM source and receiver systems enable high-resolution 3D surveys to be conducted using seabed logging. Feather believes that it will not be long before the technique offers the exciting prospect of being able to provide reserves estimates before wells are drilled. The challenge then will be to demonstrate the accuracy of the measurements for accounting and regulatory purposes.

Judging the evidence so far and the reactions of many of the leading exploration players, seabed logging is one of the most important developments in exploration technology that the industry has seen for decades. And the impression is that there is more to come. ■



***Accelerating prospect delivery: Three seismic leads are identified in this 1,000-km<sup>2</sup> imaginary frontier area (left). Scanning quickly confirmed two of the seismic leads and revealed a major new stratigraphic lead that had not been identified from seismic data (right). One of the seismic leads had no seabed-logging response. As it is unlikely to contain hydrocarbons, it can be dropped from the portfolio.***