

## exploration 1

Exploration for oil and gas in the 21st century is not an easy business. Most of the giant fields have been found, explorers now have to go deeper and look for more elusive, more fragmented structures. Large new discoveries are now less likely to be made in what have long been traditional oil and gas areas such as Borneo, West Africa, the North Sea and the Gulf of Mexico.

# RENAISSANCE

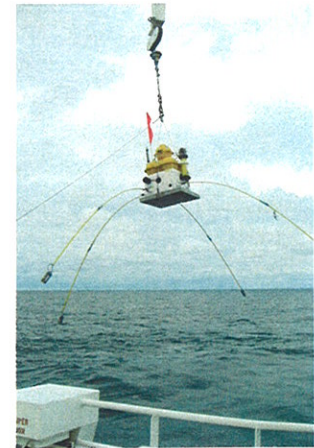
At the end of last year, Shell not only announced that it will be spending some \$1.5 billion per year on exploration in 2005 and 2006 but also unveiled how its strategy will include targeting new positions in key areas - new material oil, unconventional oil and integrated gas. Taking up this challenge is Shell's global exploration division headed by Exploration Director Matthias Bichsel. "Exploration is like a strategic fight, pitting our skills against nature," he says, "and we are about to enter the new battlegrounds." Bichsel describes these battlegrounds as areas of large, yet-to-find resource volumes that that have hitherto been too remote, too costly or not easily accessible for other reasons.

Recent new battlegrounds are Ultra and Ultra-ultra deepwater - water depths beyond 10,000ft - and hostile areas such as the arctic, or the deserts in the Middle East, where Shell, together with its partners is exploring the "empty quarter" area. Many of these battlegrounds are not necessarily virgin areas. The majority are proven hydrocarbon provinces where at least some of the "easy" oil and gas has been found. So how will Shell make the difference, and succeed where others have not?

Mike Naylor, Shell's exploration technical director, thinks he knows the answer. "In this next exploration wave," he says, "technology integration is the key - in particular merging non-seismic with seismic methods." According to Naylor, we are approaching the limits of what exploration-scale seismic can tell us. Drilling is becoming more costly, so we need independent techniques to back the seismic up, telling us more about the conditions several kilometres below the Earth's surface. This embraces not just the structure, but the nature of the rocks, and the type of fluids they contain. "In this way," he adds, "we can try to detect large accumulations controlled by stratigraphic changes as well as structure in a much more robust way than we have been able to do in the past."

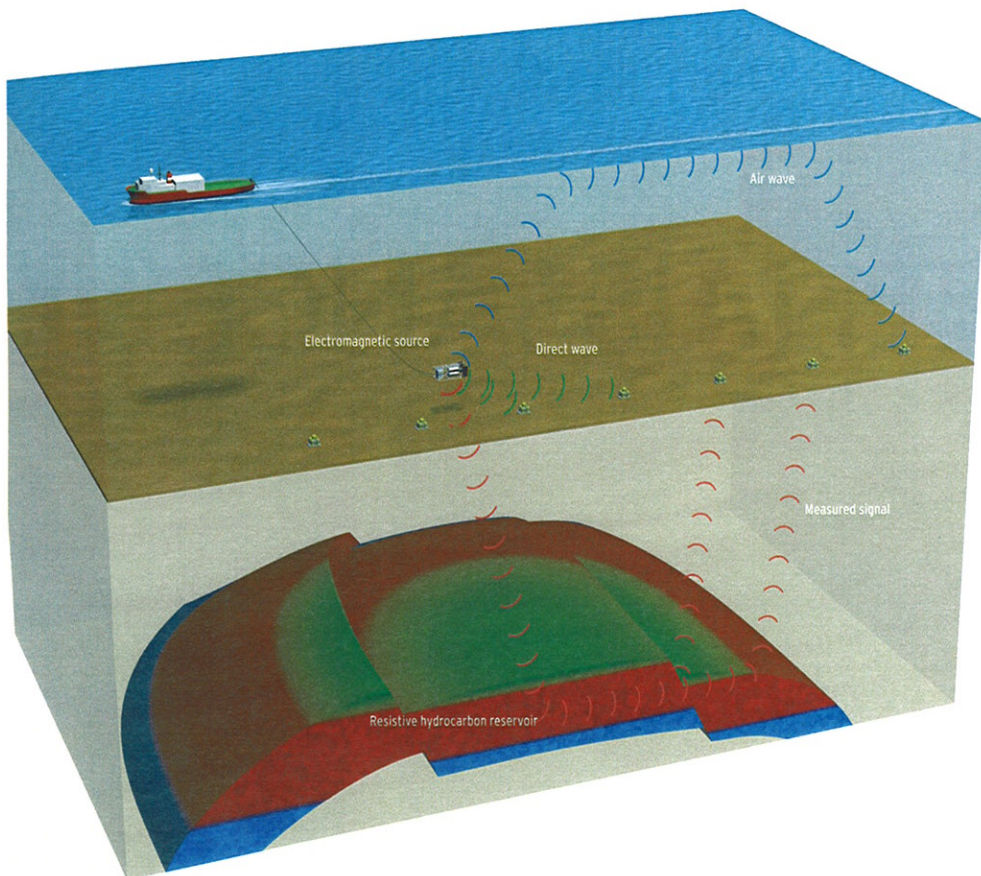
### CATALYST

This is now becoming possible, Naylor believes, because of a renaissance in non-seismic technologies based on electric, magnetic and gravity measurements. In part, the catalyst has been new hardware emerging from the declassification of secret defence technologies and the massive computing power now available to make complex calculations a reality.



"We've recognised both the challenge and the opportunities this renaissance brings," Naylor says, "and have put a focussed technology implementation programme together to capture the value now available. Alongside our own technologies, we also seek out those provided by small independent companies with whom we work very closely." The programme concentrates on non-seismic technologies that are readily

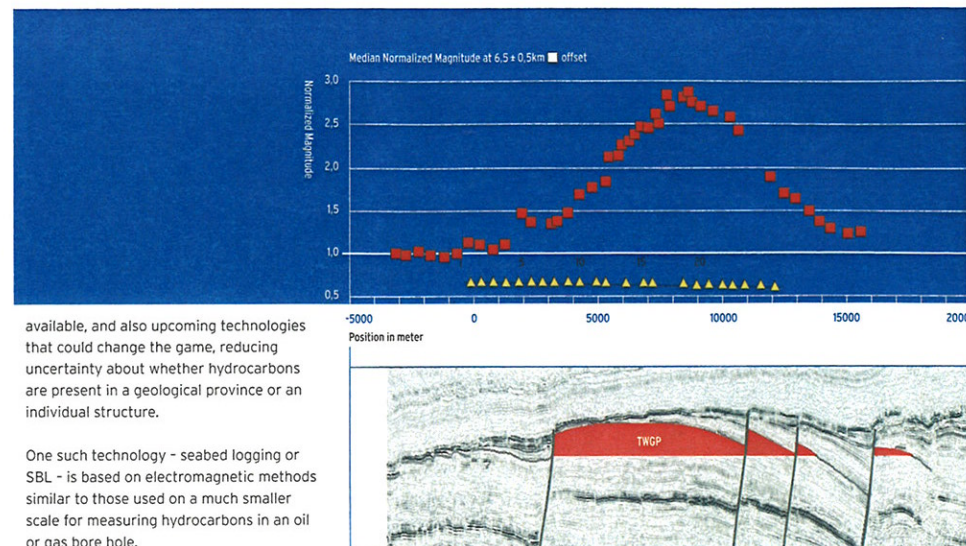




#### SEA BED LOGGING

Imagine a bore hole logging system turned on its side, with the seabed replacing the wellbore. The whole oil field, many kilometres across and perhaps two kilometres below the sea bed, replaces the small section of reservoir rock which is measured in the borehole.

By using a very powerful low-frequency electromagnetic source, technical specialists create signals with wavelengths of several kilometres, in contrast to the few metres used in a wellbore. These signals travel deep into the earth and, by measuring the returns with sensors placed on the sea bed, the specialists can calculate the rock's resistance to the signals. Hydrocarbons are many times more resistive than the water that is usually present in rocks, so an oil or gas field gives an abnormal reading.



available, and also upcoming technologies that could change the game, reducing uncertainty about whether hydrocarbons are present in a geological province or an individual structure.

One such technology - seabed logging or SBL - is based on electromagnetic methods similar to those used on a much smaller scale for measuring hydrocarbons in an oil or gas bore hole.

"The technology can't show the shape of the oil field yet," explains Naylor, "but only the presence of hydrocarbons. It should be used together with seismic and other methods. Technology integration is the watchword here."

#### ENCOURAGEMENT

Both Exxon and Statoil independently developed this electromagnetic technology in the late 1980s and Shell has been involved with Statoil in conducting tests for several years. The method has shown excellent results over known fields such as Troll in Norway. Statoil formed a spin-off company to implement SBL, and this is now the independent ElectroMagnetic Geophysical Services company of Trondheim (EMGS).

Shell's exploration division worked with EMGS in 2004 to purchase existing SBL data in Brazil and acquire new data in Norway, West Africa, Egypt and the Far East. The results are already expected to add value, with readings showing encouragement over undrilled structures. Shell is setting up a research group to look at how best to integrate the new

technology. Naylor concludes "It's early days yet. We still have to get more from this method - at the moment it only works well in deep water and for relatively shallow accumulations."

#### WORKFLOW

If these techniques and technologies are provided by service companies and available on the open market, how can Shell be confident it can use them competitively? Naylor explains: "The integration we need is not just with a pair of technologies such as SBL and seismic, it's the whole technical workflow." Shell's EP research division now uses a 'shared earth' workflow that starts by looking at the basic properties of the rocks. It maps out what is being told by the geology, what the rocks will be like in certain situations

and how they will respond to various measurements. The workflow is called Integrated Exploration Risking (IER) and combines the geological and geophysical frameworks.

"Integrating the technologies is therefore, just one aspect. Integrating the ways in which we apply them completes the now much wider exploration picture," says Naylor.

Naylor sums up: "I'm confident that non-seismic technologies like SBL will provide a much-needed renaissance for Exploration. But there are many others, such as those based on airborne and satellite measurements. Like Renaissance man, the new explorer will need to be skilled in much more than just one subject." ■