emgs recently selected Concept Systems (an I/O company) to provide exclusive positioning and data management solutions to support its field operations.

Seabed Logging

It's All about Finding Hydrocarbons

Dave Ridyard has spent 25 years in the 3-D seismic industry, including almost a decade at Input/Output. Earlier this year, Dave joined emgs (the leader in the rapidly emerging field of Seabed Logging – SBL). On Point asked Dave to help its readers to understand how SBL is reducing risk and creating value for offshore operators.

On Point: Dave, welcome to On Point. Please tell us about SBL.

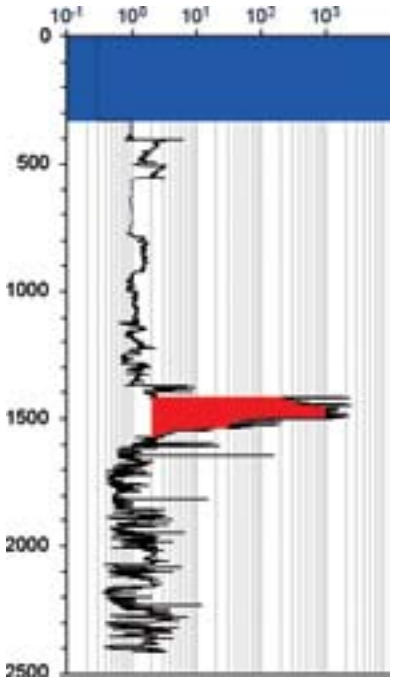
Dave Ridyard: The principle is very simple – hydrocarbon-saturated rocks typically show higher resistivities than rocks saturated with water. SBL records the presence of electrically resistive bodies in the earth. The technique is able to detect commercial levels of hydrocarbon saturation, effectively discriminating between these and low-saturation (noncommercial) fizz gas. Using the latest controlled source electromagnetic technology, it is now possible to take measurements on the seabed that determine subsurface resistivity… before actually drilling a well.

On Point: It sounds like an incredibly valuable technology. Presumably if you see high resistivity within a prospective structure, you can drill with confidence, but if you see low resistivity, you can save the cost of a dry hole. How does an SBL operation work?

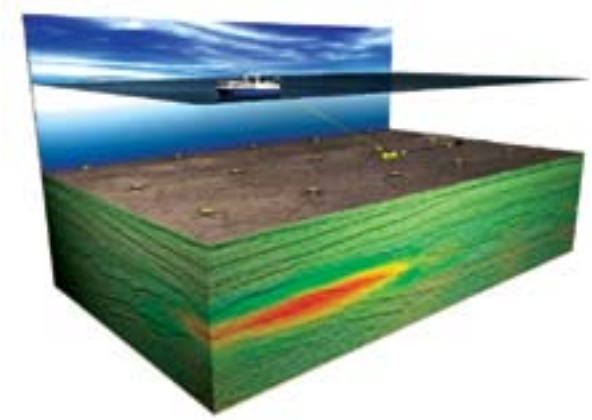
Dave Ridyard: SBL employs a powerful electromagnetic (EM) source that is towed close to the seabed. Receiver nodes resting on the seabed measure the electric and magnetic fields at various offsets from the source. The data can then be processed to create resistivity profiles using depth imaging, inversion and other advanced techniques.

On Point: Where did SBL come from?

Dave Ridyard: EM techniques have been around for a long time. The Scripps Research Institute and the Defense Advanced Research Projects Agency used the technique for military and academic applications early on.



Borehole logging: For over 75 years, the primary method for determining the presence of hydrocarbons at various burial depths has been by using resistivity logs acquired with instruments delivered to the subsurface using wireline or while-drilling techniques. SBL now offers the opportunity for logging… without drilling.



Seabed logging delivers subsurface resistivity information before drilling a well. Although the resolution is lower than from borehole logging or seismic imaging, the technique is an excellent "edge detector" and greatly improves reservoir delineation.

By Dave Ridyard - emgs

Exxon was involved in some early experiments too. The real breakthrough came when Terje Eidesmo and Svein Ellingsrud, then researchers at Statoil, recognized that the physics of EM propagation in hydrocarbon reservoirs favored the use of long offset measurements. The technique was tested successfully on the Troll field in the North Sea and in offshore Angola. These tests were a great success, and emgs was created by Statoil to commercialize the technology. The growth of emgs has been supported and accelerated by significant funding from Warburg Pincus. Terje and Svein have been with emgs from the start, and they continue to provide technical and commercial leadership.

On Point: Is the technology mature?

Dave Ridyard: We are building on over 30 years of experience in the field of marine EM techniques. However, their application to finding hydrocarbons is relatively new. Consider where seismic acquisition was in the late 1970s: digital multi-channel recording was standard, 2-D seismic acquisition was a proven exploration tool and 3-D techniques were emerging from the research labs. SBL is at a similar stage of development, but we have the huge advantage of being able to accelerate the learning curve dramatically by making use of the huge body of knowledge acquired over 30 years of trial and error in 3-D seismic. The really good news is that, even in this early stage of the technology's development, customers like Shell are publishing lots of success case histories describing how SBL has contributed to both finding oil and avoiding dry holes.

On Point: Does emgs have competitors in the field?

Dave Ridyard: emgs acquired the first commercial SBL survey in 2002. There are now a couple of companies applying similar concepts, but we have a strong leadership position. We have three crews in operation, and we have acquired more than 150 surveys in every major basin around the world. No one can match our technology, operational experience and track record for quality and safety. We are focused on growing the market and innovating. We do not spend much time looking over our shoulders at the competition.

On Point: Are there any environmental issues related to SBL?

Dave Ridyard: No. It is a very benign technology. We even have a patented biodegradable concrete for the base of the seabed receivers; these have to be left on the seabed after a survey. Our biodegradable anchor design also avoids the use of any metal components. Customers who request this option can be sure there is no trace left after their survey has been completed.

On Point: Should seismic companies be nervous about competition from SBL?

Dave Ridyard: No. On the contrary, SBL provides clear delineation of the quality, quantity and extent of hydrocarbons, but the EM wavelengths involved preclude SBL from providing high-resolution structural and stratigraphic images. In fact, SBL actually makes seismic data more valuable. They are very complementary technologies, and I think technical and commercial collaborations between emgs and seismic players will emerge as more oil companies continue to establish SBL as a routine part of their field development cycle. I would like to think that emgs will grow its business by taking money away from the budgets normally allocated to drilling dry holes!

On Point: Where is SBL most effective?

Dave Ridyard: We have conducted SBL surveys in water depths of less than 100 m, and greater than 3200 m. Oil companies are most excited about the deepwater opportunities, where the stakes are much higher. Deepwater wells are so expensive that oil companies want to be sure that every well counts, and SBL dramatically reduces the risk of dry holes in deep water.

On Point: Typical wildcat success rates are around 15 to 20% today. What sort of success rates can SBL users expect?

Dave Ridyard: One of the great features of SBL is that you can model the results very accurately. Assuming that we have some knowledge of the geologic setting, we can model the results with and without hydrocarbons present. We can then tell our customer whether SBL will be able to identify hydrocarbons in a particular structure. If the model says SBL won't work, then we don't perform the work. emgs declines to provide services to about 75% of customers who approach us with potential SBL projects. As a result, if we perform an SBL survey, and the results indicate a hydrocarbon-related resistive feature, our customers can expect the probability of success to be in excess of 90%. This is unheard of in an exploration environment.

On Point: Where is SBL not applicable?

Dave Ridyard:Historically, SBL has been less effective in shallow-water areas and in areas where salt and volcanics can create non-hydrocarbon-related resistive features. Our current source technology further restricts us to

the first few kilometers below the seabed. However, there is a lot of research going on in all these areas, and I think you will see these challenges overcome in the next few years.

On Point: Can you apply SBL on land?

Dave Ridyard: Seawater is an electrical conductor so the physics are rather different on land. The economics of drilling are different too. EM techniques can provide value onshore, but the challenges are different, and we have no plans to address onshore opportunities at the moment.

On Point: You mentioned 3-D SBL as an emerging technology. Tell us about this.

Dave Ridyard: 3-D revolutionized seismic acquisition, and we think it will do the same for SBL, but these are early days for 3-D SBL. We have performed one major 3-D survey, and so far, the results are very encouraging. The arguments are very similar to the arguments for 3-D seismic. If we can fully sample the EM wavefield for a broad range of offsets and azimuths, we can accurately reconstruct the resistive volume. Eventually, SBL will be able to deliver 3-D volumes indicating accurate locations for hydrocarbons, and delivering accurate reserves evaluations before a single well is drilled… but this is a few years away!

On Point: What else does the future hold for SBL?

Dave Ridyard: We see a huge application for SBL scanning. This is surveying using coarse survey grids that are designed to identify the presence of reservoirs of a significant size, but without attempting to characterize them in any detail. This application has particular value in frontier exploration areas. Several of our customers are now going into new areas and acquiring rapid, low-cost resistive anomaly maps. These maps can be used to target seismic programs in areas where hydrocarbons are known to exist, and to ensure that leasing and licensing strategies are optimized. Even in very mature areas, we have seen that SBL can detect play types that just do not show up on seismic data. Several oil companies are now scanning their old fields to see if they have missed anything significant before disposing of mature assets.

On Point: It sounds like the future for SBL is bright. We wish you and emgs all success in the future.

Dave Ridyard: Thanks for the opportunity to spread the word about SBL. OP