OCEAN BOTTOM SEISMIC
A KEY TECHNOLOGY OFFSHORE WEST AFRICA

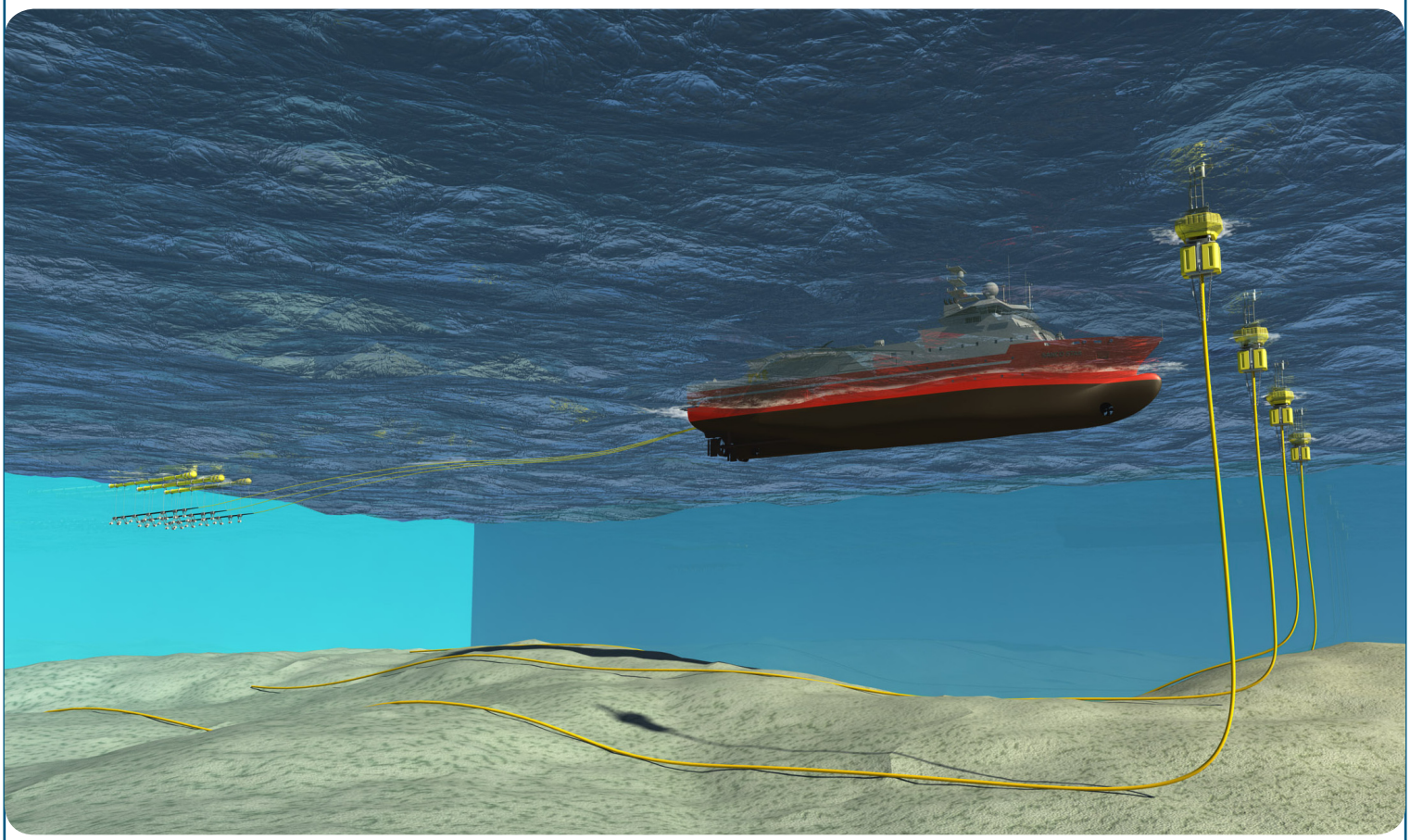
Seabed seismic data acquisition can be applied to many seismic and geological challenges and improve reservoir characterization and management. The technology has in recent years become strategic for many oil companies in their de-risking of wells and recovery factor improvement.

By placing sensors on the seafloor and decoupling the source and receiver, the acquisition lay-out and equipment ensures a number of benefits are achieved now making Ocean Bottom Seismic (OBS) a proven technology delivering results unique to this technology as well as resolving many streamer seismic limitations.

This strategic application is seen in West Africa where RXT has been acquiring Ocean Bottom Cables (OBC) seismic in since 2007. The company has developed a very strong presence in the region, especially in Nigeria, working for clients like Afren, MPN (ExxonMobil Nigeria), Chevron and Total.

RXT acquires OBC seismic using a number of steal cable that each is connected to an autonomous buoy, which records all data making it possible to retrieve data without retrieving the cable. For every 25 or 50 m the VSO cable has a hydrophone and three orthogonal geophones or accelerometers laying on the sea floor acquiring 4C data.

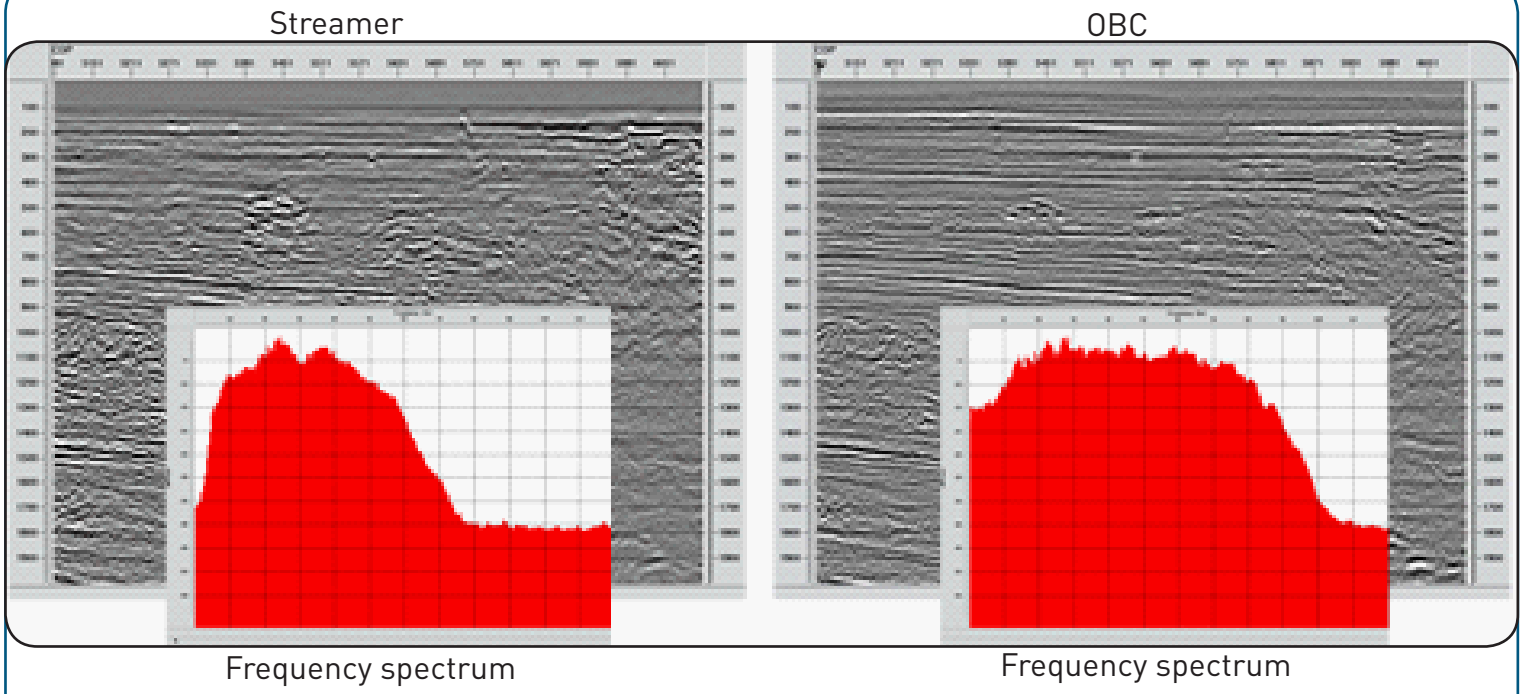
4C seismic has a number of benefits compered to streamer data with just a hydrophone. Both compressional data and converted shear wave data volume are acquired. The PP data consists of a down going compressional wave that is reflected and recorded as a compressional wave at the sea bed. The PS data consists of a downgoing compressional wave that is reflected and converted as shear wave and recorded at the sea bed.



The autonomous VSO OBC system from ION that is using cables connected to a buoy for power generation and data recording.

The future is on the seafloor

RESERVOIR EXPLORATION TECHNOLOGY



Bandwidth comparison of streamer and VSO OBC seismic data. The OBC data enables a more detailed interpretation and better fault definition and the low frequency information.

Placing sensors at the seafloor provides significant benefits in comparison with streamer data. Two sources of noise which impact both data quality and operational performance of towed streamer surveys are avoided by placing the sensors on the sea floor. The noise arising from towing the sensors through the water as well as the noise induced by the movement of the sea surface is eliminated. By combining from the geophone and hydrophone data it is also a straight forward process to separate the recorded data into upward and downward travelling components, which can be used efficiently in multiple elimination. By placing the sensors on the seabed optimal coupling is also achieved and with a shorter ray path OBC provides superior bandwidth in comparison to streamer data.

These benefits of OBC seismic can be achieved in highly obstructed areas as it is possible to deploy cables close to subsurface and surface infrastructure providing a better data coverage and reducing the need for undershooting.

To improve imaging in connection with complex geology and salt structures OBC provides the opportunity for wide-azimuth and full-azimuth designs, as there is a lot of flexibility in how to place the receiver arrays relative to the source arrays.

Multiple vessels and multiple passes are not required with OBC in order to acquire wide azimuth data making OBC competitive with streamer data.
As converted shear waves are acquired the issue of gas clouds can be resolved as the shear waves are insensitive to gas and can image both within and below the gas cloud. The insensitivity of the shear waves to both oil and gas provides unique a hydrocarbon prediction attribute as well. The compressional data will be influenced by hydrocarbons, however the converted shear wave data will not be influenced by the presence of hydrocarbons in the reservoir. It is therefore possible to separate between a lithological/diagenetic effect and hydrocarbons, as an amplitude brightening on the PP data will only be a hydrocarbon effect if not present on the PS data.

With a number of additional benefits like being able to do better seismic reservoir characterization using seismic inversion the application OBS as a strategic technology will increase especially as many of the oil field challenges which are also seen in West Africa can be resolved by OBS.

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