



# Quantum leap for seismic

The introduction of Q-Marine\* technology a few years ago has given WesternGeco a competitive edge, the company claims. In the Oslo Technology Centre they are proud of having been crucial in the development of seismic technology that, beyond any doubt, has given some oil companies value for money.



WesternGeco, now owned in full by Schlumberger, is in the process of upgrading their fleet to Q-Marine Technology. The development of this technology, including improvements of both the source and receivers, was done in the WesternGeco Oslo Technology Centre that was founded in the early days of Geco in the 1970's.

Morten Svendsen (left) was Product Champion for WesternGeco when developing the Q-Marine system between 1997 and 2001. Morten is now Chief Geophysicist Marine, while Ottar Kristiansen is Product Development Manager, Marine Acquisition Systems, in the Oslo Technology Center. This centre is responsible for the development of all aspects of acquisition of marine, land and seabed seismic data.



Photo: Halfdan Carstens

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### Halfdan Carstens

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"We distinguish between conventional seismic and Q-Marine seismic," says Morten Svendsen, Chief Geophysicist Marine with WesternGeco. "While conventional seismic has been crucial in exploration for many, many years, Q-Marine technology provides the possibility of, not only locating, but also managing offshore reservoirs throughout the life of the field."

For almost five years, Svendsen participated in the development of Q-Marine single sensor seismic system, and he strongly believes that introducing the new technology was a quantum leap forward, not only for WesternGeco, but also for the entire seismic industry. "Q-Marine applications now allow the petroleum industry to look beyond exploration and fully apply seismic technology in reservoir management," he says.

"Until the Q-Marine system was introduced, there were several *evolutionary* improvements of seismic acquisition technology since digital recording was introduced in the early 1980s, but the first really *revolutionary* concept change and data quality improvements came with Q-Marine technology," Svendsen claims.

### Centre of Excellence

Morten Svendsen and his colleague Ottar Kristiansen are based in Asker outside Oslo, Norway, in what is known as the WesternGeco Oslo Technology Centre, one of several Schlumberger technology centres around the world. This centre has great ambitions being responsible for developing seismic acquisition systems for marine, land and seabed seismic.

"This is an exciting place to work. We are in a position to follow projects from idea inception until they are classified as commercial products. This includes design, testing, prototyping, manufacturing and commercialization. Also, we get project responsibility at an early stage, which is good," says Ottar Kristiansen, Product Development Manager of Marine Acquisition Systems in WesternGeco.

The centre is also an interesting workplace from another viewpoint. "More than 340 employees belong to it, and they come from all over the world. With 32 nationalities present, of which non-Norwegians represent 40 per cent of the staff, we have a wonderful opportunity to get acquainted with people from other cultures," Kristiansen says. "Also, because they all come from different universities and have different

\* Mark of WesternGeco



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The WesternGeco Oslo Technology Centre includes an in-house training centre for seismic crews. It operates in much the same way as airplane pilot training centres. Crewmembers are exposed to real-life situations with small and big problems causing intermittent periods of stress. In fact, airline pilots are used as consultants when training the engineers because of their unique experience in dealing with stress. The screen gives a view of the scenery behind the seismic vessel, as observed by the operator, while the small monitors show the same information as would be displayed on the ship. With background noise and simulation of real events, capable of causing problems when acquiring data, such as, for example, other vessels unexpectedly crossing their course, the training facility duplicates real-world situations.

experiences, we get exposed to various ways of handling the challenges that we are presented every day."

## Q-Marine

"Q-Marine technology results from many years of detailed work analysing the key sources of noise and error when acquiring seismic," Svendsen says. He lists four main components that impact quality and repeatability of the data.

"To start with the signal, we have introduced a digital source controller system that measures the source output from each shot and enables removal of the variations in the signature of the airgun source.

Seismic data quality naturally improves significantly when the signal is consistent."

"Secondly, with conventional seismic acquisition, signals from hydrophones within a group are wired together and summed into one trace, resulting in signal perturbations and smear. With single-sensor recording, however, all signals are recorded and sophisticated new types of filters can be applied. This reduces noise and gains resolution."

The other two improvements are related to receiver positioning.

"New steering devices enable precise depth control and horizontal streamer positioning, thereby providing feather correction and controlled streamer separation. With up to 12 cables being towed in different types of weather and strong currents, it is easy to appreciate the necessity of having full control. In several 4D projects, the streamers have been steered as close as 40 meters to fixed platforms, something unheard of with conventional seismic acquisition technology."

"Finally, a new acoustic positioning system improves positioning accuracy from the front to the tail of the streamers. Detailed knowledge of the location of the receivers is, of course, particularly crucial for time-lapse data," Svendsen explains.

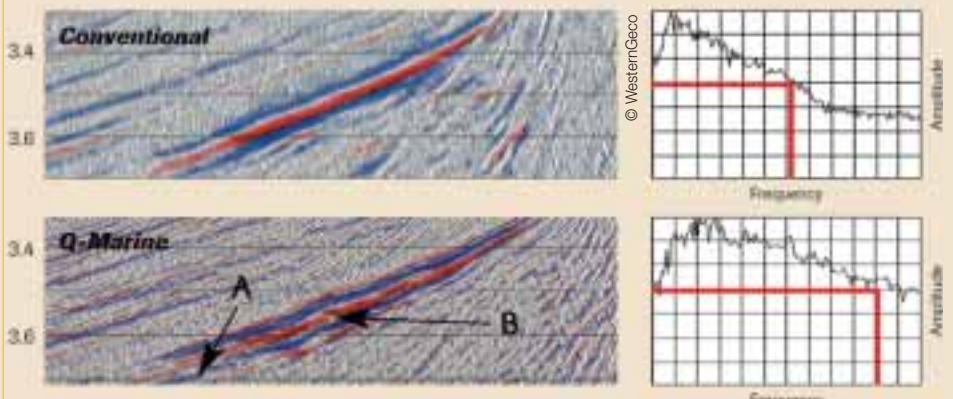
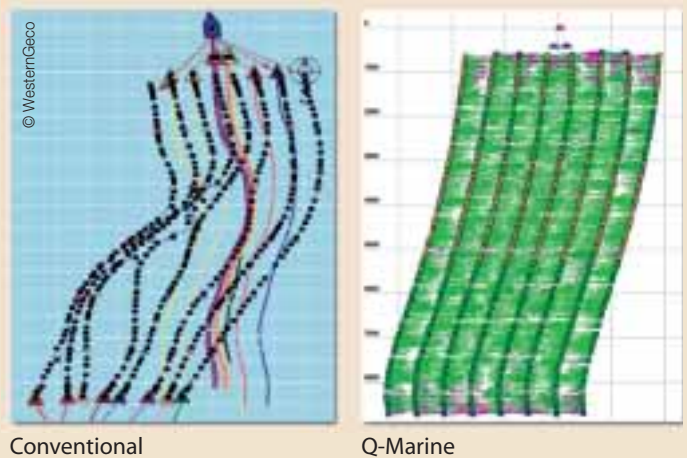
## A survivor

The WesternGeco Oslo Technology Centre, nicely over-looking the beautiful Oslofjord, was originally the R&D division of Geco. Geco was acquired by Schlumberger in 198x and was later merged with Western. WesternGeco is now the world's largest seismic company.

Having survived as a "centre of excellence" since the 1970's - through more than 25 years - is certainly a feat in itself, these days. Surviving in the Schlumberger system as one of few technology centres should be a good indication that it has been able to sustain quality through the years.

"It is well respected within Schlumberger," Ottar Kristiansen concludes.

You don't need to be a geophysicist to appreciate that the Q-Marine system has the potential to acquire better three-dimensional data than conventional systems. This figure illustrates how the cables are kept in constant relative position when influenced by strong currents.



An example from a deepwater field in the Gulf of Mexico demonstrates how Q-Marine technology can improve seismic data resolution. With improved recording technology, in this case it is possible to see both the contact between oil and water (A) as well as gas and oil (B). The conventional seismic data gave no clues to these important features.