

# Today's technology for tomorrow's oil

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**U**p to the early 1980s land and marine seismic surveys were generally 2D where the geophones and hydrophones picked up reflections from a slice through the earth. In the past 25 years modern technology has allowed surveys to measure in a 3D mode, where the earth is modelled as a cube.

Now explorers can see a broad picture instead of a single slice and to achieve this resolution modern seismic technologies include sophisticated energy sources, recording systems sampling between 3,000 and 20,000 data points or receiver locations simultaneously and geophones or hydrophones.

In a modern 3D land survey upwards of 100,000 geophones are seeded into the surface. The geophones are grouped into arrays comprising up to 72 geophone elements, each array is tuned to reject noise and pass the signal, similar to a sophisticated antenna.

Today's geophone is a precision measuring instrument based on a coil suspended by springs in a magnetic field, within a steel case. When vibration of any sort moves the case, the coil remains stationary due to its inertia. This movement of the case in relation to the stationary coil generates an electrical voltage proportional

to the velocity of the case with respect to the coil (with a displacement as low as nanometers).

To achieve the resolution needed to map accurately

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the seismic industry today demands tight specification tolerances and Sensor - the Netherlands based geophone manufacturing division of I/O - has set the industry standard.

A geophone with a 10Hz natural frequency will operate within plus or minus 2.5 per cent tolerance; harmonic distortion will be less than 0.1 per cent, sensitivity and coil resistance both plus or minus 2.5 per cent and the damping set at plus 5 per cent and minus 0 per cent.

Geophones of poor quality will provide equally poor data, resulting in the map or section no longer being analogous of the earth's interior, perhaps resulting in a lost drilling opportunity.

Geophones need to be exceptionally rugged in their design: On a seismic crew geophones are routinely stepped on, kicked around, thrown out of the back of trucks and in some cases, even dropped out of helicopters.

To ensure performance Sensor tests one per cent of their geophone production each day. Geophones are subjected to 1,500 g mechanical impacts, at a rate of 1200 impacts per hour, for up to ten and a half hours.

Finding a 50 foot geological play 30,000 feet below the surface demands precision measuring equipment.

The Sensor Division of I/O builds the geophones that are used on the majority of the world's land seismic crews and market feedback indicates there are eight million Sensor geophones working today throughout the world. ■

Sensor manufactures in Europe and the Middle East. For more visit: [www.i-o.com](http://www.i-o.com)