A digital telemetry system implementation of the dual-sensor, bottom-cable method

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The bottom-cable method of seismic reflection data acquisition has been used for many years in shallow water and in areas densely populated by obstacles, where towed streamer marine vessel access is rendered impossible or risky. And as production and drilling platform obstacles have moved to deeper and deeper water, the application of the bottom-cable method has moved with them.

The location of the method's sensors at the water-bottom causes each recorded reflection wavelet to be followed by a series of water-column reverberations. As the water depth increases, the reverberation period increases proportionately, attended by a significant reduction in the ability of deconvolution methods to remove the reverberations during processing. In the frequency domain, this phenomenon manifests itself as notches which are introduced into the reflection wavelet's amplitude spectrum.

To eliminate this reverberation problem during the data acquisition and preprocessing stage, the dual-sensor method has been implemented. This method places a gimbal geophone unit with each hydrophone in the bottom-cable. The signals from the geophone and hydrophone arrays are recorded on separate channels for combination during data preprocessing. Prior to retrieving the bottom-cable for redeployment, the shooting vessel performs an additional pass. Firing the source directly over each set of geophone/ hydrophone arrays creates an artificial "ghost". The resulting data provides the information necessary to combine the geophone and hydrophone signals optimally at each receiver location to cancel reverberation energy in the production reflection data.

Since the introduction of the method, several opportunities have arisen to compare directly dual-sensor, bottom-cable data to conventional towed streamer data. In each case, the dual-sensor data has proven to be of equal or higher quality.

The most recent enhancement to the dual-sensor, bottom-cable method has been the development and deployment of a telemetry bottom-cable recording system. This new

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version of the MDS-18X recording system consists of an impulse source complement of recording subsystems in the recording cab. And the line equipment has been completely redesigned for operation under water.

The eight-channel remote units have been re-shaped to a cylindrical steel housing with bottom-cable connectors at each end. This housing is designed for operation at depths up to 200 metres. The remote units are powered from a 200 VDC power source through conductors in the bottom-cable. The cable is approximately 2.54 centimeters in diameter and contains data and control transmission pairs, seismic signal pairs, power conductors and strength members.

Each remote unit receives and digitizes four seismic channels from each of the two bottom-cable segments to which it is attached. Two channels are dedicated to each receiver station, one for the hydrophones and the other for the geophones. So each remote unit processes the data for its closest four receiver stations. The hydrophone/ geophone pairs are physically contained in a single package which is fabricated in the Netherlands. Both detectors have a natural frequency of ten Hertz.

Upgrading the dual-sensor, bottom-cable operation to a digital telemetry recording system results in higher fidelity data and higher production rates. The production rate increase stems from the increased available recording channels compared to a conventional system, allowing simultaneous recording from multiple, parallel bottom-cables.