

Land seismic acquisition: where do we stand on the receiver side?

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ABSTRACT

High quality broadband data in land seismic can be achieved thanks to a smart combination of:

- Adapted 3D design.
- Single source.
- Single sensor.
- Adapted processing.

New recording systems able to record several hundred thousand channels per recording point enable the design of high density 3D. For Vibroseis, recent technical evolutions on both software and hardware have been largely addressed with new vibrator designs, sweeping low and high dwell sweeps. Most Middle East crews are now using single vibrators and simultaneous high productivity methodologies (slip-sweep, DS3, DS4, ISS...) and record more than 10 000 VP per day. This has made cost effective high density 3D surveys accessible. Adapted processing has also largely evolved, handling terabytes of noisy data and drastically improving the final image.

The receiver side is currently the least mature of the 4 topics. Most land crews are still using strings of analog geophones with variable group interval unlike marine streamer acquisition. The number of crews using single sensors only represents a few percent of the total active crews worldwide and among these crews, only a small portion use digital phones.

After 50 years of incremental enhancements of the conventional (electromagnetic) geophone, MEMS (micro-electro- mechanical-system) technology were introduced fifteen years ago for geophysical exploration, but they still represent today a marginal portion of the total number of sensors sold every year. Today's latest generation of MEMS with high sensitivity, light weight, low power consumption, high fidelity and very low noise floor has now surpassed the technical drawbacks when compared to conventional geophones. Even at very low frequency, where the noise floor can still be higher than the industrial or ambient noise in very quiet environments, this noise is largely oversampled thanks to the high density of single sensor and thus well attenuated on high fold stack.

The last blocking factor is economic. When analyzing the cost of seismic sensors, it is necessary to separate between the capital expenditure of the equipment and the operational expenses to transport, deploy, retrieve and maintain such equipment.

Reducing the cost in both of these areas are current ongoing processes:

- The cost of building this equipment is steadily reducing with mass production.
- The cost of the deployment logistic is also reducing with a streamlining of the field process as well as a reduction of the HSE exposure.