

PDO's Nodal Seismic Acquisition in Severe Sand dunes: Safety, Operational Efficiency and Data Quality

Israa Al-Hinai¹, Mohammed Al-Hosni¹, Ahmed Al-Raqmi¹, Ali Al-Ismaili¹, Taimur Al-Wadahi¹, Forbes Clow², Sa'aed Hanna²

¹PDO

²Geo-Resources Consultancy

Abstract

This paper will present PDO seismic acquisition innovations utilized to overcome the operational and data quality challenges in a severe sand dune environment.

In 2022 PDO embarked on the seismic acquisition of one of the most challenging exploration areas of the Sultanate of Oman in a severe sand dunes environment with extreme temperatures of up to 50 degrees Celsius and sand dunes heights exceeding 120 m. Accordingly, to deliver a fit-for-purpose, safely executed and high-quality product, suite of innovative ideas were implemented to reduce HSE exposure and cost, enhance production and bulldozing efficiency and increase the seismic data quality in the sand dunes environment.

To reduce HSE exposure, a nodal acquisition system was deployed with state-of-the-art drone-based QC monitoring. This reduced the number of personnel involved and kilometres driven in the field for both deployment, pickup and troubleshooting by more than 35%, compared to legacy operations. For data quality optimization, a variable sand dune sampling was used to improve the offset distribution, S/N ratio and fold coverage. On the nodal receivers, a primary template of 48 k nodes was used with daily QC while a secondary 20k receiver patch was used as infill, which was more robust in sand dunes, these nodes were lighter, and easier to deploy, however without daily QC. This resulted in a substantial uplift in fold coverage & sampling (Figure 1) [ASX1] leading to an improved S/N and offset distribution. The bulldozing effort required for vibrator and recover sand dune access in this project, was reduced significantly compared to legacy operations. This was achieved through a smart sand dune cutting methodology utilizing the least-resistance path facilitated by advanced terrain classification and slope analysis and complemented with a GPS dozer guidance system. This resulted in above 100% uplift in cutting efficiency and reduced the required bulldozers by more than 35%.

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