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First Onshore 3D Seismic Survey in Mozambique – Overcoming Acquisition and Processing Challenges

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Summary

Since its introduction, the benefits of 3D seismic data are well understood by the Oil & Gas industry. In the onshore realm the challenge often comes in demonstrating the value of these benefits within its own acquisition and processing limitations. This paper highlights some challenges encountered during the acquisition and processing of the first 3D seismic survey onshore Mozambique by Sasol in 2016 and how they were overcome to demonstrate the value of 3D seismic in one of its operated fields.

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Objectives

The primary objective of the 3D seismic survey focused on refining existing subsurface models to support the exploitation of the Inhassoro oil reservoirs from Upper Cretaceous, Lower Grudja reservoirs in the Mozambique Basin. The prior subsurface view was derived from a sparse grid of different vintage 2D seismic lines, with the characterisation of the generally low relief hydrocarbon reservoirs being one of the key remaining challenges.

Challenges

Acquisition challenges on an onshore seismic survey are numerous, including surface geology, infrastructure, hazards, weather and environment. Of these, environmental and man-made hazards (unexploded ordnance) comprised the greatest operational challenges in the Inhassoro area. Even though Mozambique has been declared a mine-free country, it does not mean that unexploded ordnance does not still exist.

The 3D survey area is located in a diverse environmental area with bush, forests, waterways, beach/coastal zones and an extensive critical habitat covering over 10% of the survey area (figure 1). These challenges were overcome with collaboration with the Mozambique agencies to minimise both short and long term environmental impacts. Techniques employed were;

- Hand clearance of receiver lines (width <2m)
- Hand deployment of receiver equipment
- Minimal mechanical width clearance for source lines (<6m)
- Smaller source units in critical areas (lines cleared by hand, width 2m)
- Regeneration of cleared lines
- Use of existing cleared land (roads, legacy 2D seismic lines) to minimise clearance

Two seismic sources were deployed, a fleet of Vibroseis units (figure 2 a) and an Accelerated Weight Drop unit (figure 2 b) in the Critical Habitat areas.

Key seismic processing challenges included statics, noise attenuation and data regularisation. The new 3D seismic dataset addressed these by;

- Utilisation of 3D algorithms
- 3D statics solution
- Common Reflection Surfaces

Examples of how these have affected the structural interpretation of these low relief reservoirs and the faulting patterns will be presented.

Conclusions

The benefits of a 3D seismic survey can be realised on the onshore realm in Mozambique, despite the acquisition and processing challenges entailed.

The new 3D image grid provides significant improvement in inter-well subsurface coverage compared to the existing 2D grid. This has led to enhanced subsurface understanding and an increased confidence in the interpretation of the reservoir zones and tectonic framework.

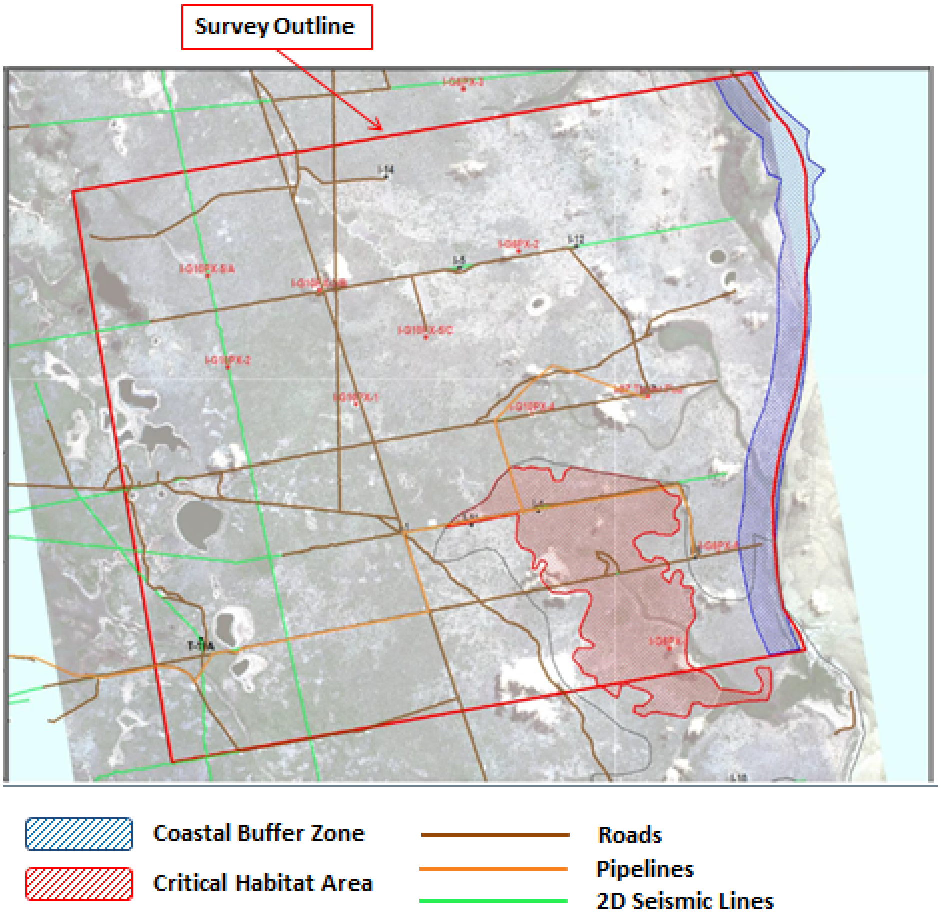

Figure 1 *3D seismic survey area with surface limitations and infrastructure.*

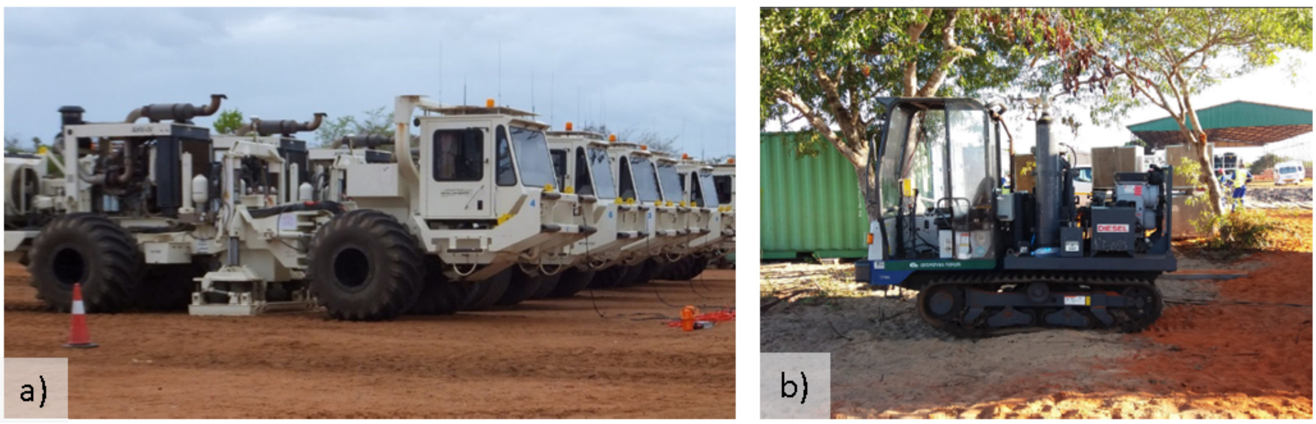

Figure 2 *Source employed a) Vibroseis and Accelerated Weight Drop (AWD).*