State of the art 3D seismic for the Pre-Caspian subsalt in the Karachaganak Field

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The Pre-Caspian Basin is home to some world class hydrocarbon fields, however their geological setting can be very challenging for the seismic technique: deep carbonate platform targets with complex overburden including highly rugose salt structures provide imaging challenges, whilst complex near surface geology and oilfield infrastructure generate challenging noise environments for seismic acquisition. The Karachaganak field, onshore Kazakhstan, is a leading example of such an environment. BG Group and eni E&P, joint operators of Karachaganak, on behalf of KPO, along with partners Chevron and Lukoil, set out to improve the resolution of the existing 1999 seismic survey and enable long term development of the field.

To create a state of the art 3D seismic volume it was necessary to invoke some of the latest technology advances, while ensuring HSSE compliance to the strictest global standards. This paper is a case history of simultaneously leveraging the benefits of the latest relevant technologies with local experience and knowledge. That process took several years of feasibility planning, testing, and design, leading to eventual execution in the 2009 summer season.

An extensive integrated feasibility study was conducted, complemented by a seismic test. This test confirmed the need of long offsets and wide azimuths for optimum imaging of the pre-salt targets. It also allowed a fine tuning of the source effort necessary to achieve adequate illumination of the targets.

The survey execution exceeded local and international standards and in doing so validated a collaborative trans-national model and successfully introduced leading-edge techniques into the region. In deploying up to 18,000 live channels and 5 fleets of vibrators acquiring up to 2,800 vibration points per day, 1 Petabyte of geophysical data was acquired over 6 months giving a volume over 800 surface sq km, 300 fold, on a 20x20m surface grid, with offsets in excess of 9 km. The volume was acquired within the seasonal weather window and without any HSSE incident.

The acquired volume avoids the acquisition compromises away from best field practice imposed in previous decades by equipment limitations. Despite the significant logistical constraints of survey area access, single season timeframe, and costs, early processing indications are encouraging. When fully depth image processed, the expectations are that it will yield a high spatially sampled full azimuth long offset dataset with improved resolution. Thus new technology will have enabled better characterisation of this complex carbonate reservoir, adding future value to the ongoing development of the field.