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The Longest Challenge: Overview of a Groundbreaking Horizontal Well in Gimboa Field, Angola

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Abstract

In February 2008, a national operator set a new record for the longest horizontal drainhole drilled in Angola. The well (drilled in the Gimboa deep water field) measured 1664 meters of total length, and was successfully placed within a multiple-lobed reservoir with highly variable thickness. This paper provides an overview of the well placement process, with particular focus on the aspects of job planning, which played a critical part in the success of the operation.

Preliminary investigation in Gimboa offsets wells had revealed the presence of horizontal and vertical permeability barriers within the targeted reservoir. This added considerable complexity to the trajectory planning and execution. Ideally, the borehole path would have to connect as many reservoir lobes as possible, without exiting the main boundaries. The well also needed to drain two reservoir segments, separated by a major fault of uncertain throw.

Severe operational constraints were imposed. The formation consisted of unconsolidated, mechanically weak sands. In order to maintain directional control and prevent washouts, the rate of penetration could not drop below a pre-determined value. Dogleg severity had to be controlled, in order to limit torque losses and avoid problems while running completion screens.

The geological challenges were tackled using an innovative technology blend, which integrated deep directional boundary detection, interpretation of real-time borehole images, and log correlations against a model based on seismic and geological facies analysis. Formation pressure was also acquired while drilling, to verify the possibility of hydraulic communication with the injector wells. Such combination was an absolute first for Angola. Special drilling practices were applied in order to implement steering decision without exceeding the prescribed limitations.

The well achieved all the objectives, and was completed without problems. Horizontal wells are more expensive and technically challenging than vertical or deviated ones, but offer significant advantages in terms of both increased production and enhanced recovery. The Gimboa experience demonstrates that advanced well placement enables the successful construction of horizontal drain-holes even in the most complex scenarios.

Introduction

In the year 2000, Block 4/05 offshore Angola was acquired by the operating arm of the National Oil Company. In September of 2004 the Gimboa field was discovered at the southern margin of the lower Congo Basin (Fig. 1). This was the first official discovery for Sonangol Pesquisa e Produção, the Angola National Oil Operating Company.

The reservoir consists of unconsolidated sands of Upper Miocene age. Two different reservoir facies were identified in the discovery well (Fig. 2): a younger frontal splay within a fan system (Upper Reservoir) in the northwest of the prospect and an older stacked channel sequence below (Lower Reservoir), in the southeast. The Upper and Lower reservoirs are partly overlapping, but have separate fluid and pressure systems.