Sperry Delivers Vertical Well with Rotary Steerable and Saves PEMEX US$ 1.4 Million

Location: Kayab Field, Offshore Mexico

OPERATOR’S CHALLENGE – Petróleos Mexicanos (PEMEX) needed to drill a vertical exploratory well to define the boundary of the offshore Kayab field. Maintaining verticality would pose a significant challenge, as the formation presented a high tendency to cause deviation while drilling.

HALLIBURTON’S SOLUTION – Sperry Drilling services deployed a real-time drilling optimization solution including the Geo-Pilot® XL 9600 series rotary steerable system in vertical drilling mode; measurement-while-drilling (MWD) sensors including ABI™ At-Bit Inclination sensor, ABG™ At-Bit Gamma sensor and Pressure-While-Drilling (PWD) wellbore pressure measurement sensor; and the ADT® Applied Drilling Technology drilling optimization service supported from the onshore Remote Operations Center (ROC).

ECONOMIC VALUE CREATED – The optimized drilling performance of the Geo-Pilot XL system, supported by the Remote Operations Center (ROC) in Ciudad del Carmen, delivered the challenging vertical section 5.6 days sooner than planned, saving PEMEX US$ 1.4 million in platform expenses.

DELIMITING WELL – PEMEX, Mexico’s state-owned petroleum company, needed to drill exploratory well Kayab 1ADL located in 148 m (486 ft) of water offshore Ciudad del Carmen in the state of Campeche, Mexico. A vertical well was specified to define the boundary of the Kayab field, however the Pleistocene sandstone and shale formation presented a high probability of deviation while drilling. The structural section in the 17-1/2” interval had a dip of 38 degrees from 500 m (1,640 ft) to the end of the section, challenging the verticality of the well.

VERTICAL DRILLING WITH THE GEO-PILOT SYSTEM – Sperry Drilling services utilized the Geo-Pilot XL 9600 series rotary steerable system in “vertical drilling mode” and a suite of M/LWD sensors to deliver precise placement of the vertical well. The Geo-Pilot XL system provides all of the proven speed and hole quality benefits of the original Geo-Pilot system but in a hardened, more durable package specifically designed to handle harsh drilling conditions. More than just a point-the-bit rotary steerable system, the Geo-Pilot system has on-the-fly control using the Geo-Span® downlink service, sensors for precise geosteering, cruise control and now a vertical drilling mode. Early warning of trajectory and formation changes was provided in real time by the at-bit gamma and inclination sensor measurements. The combined gamma/inclination package is located just one meter (3 ft) from the bit, eliminating the wait for MWD measurements to indicate formation changes. The ABG sensor uses three independent detectors arranged symmetrically around the tool providing three
unique, directionally sensitive measurements that can allow for the identification of the location and orientation of formation changes relative to the Geo-Pilot system.

Equipped with a new vertical mode software, the Geo-Pilot system is capable of variable deflection while delivering a smooth wellbore, free from ledging and spiraling. The software provides closed loop vertical drilling control, monitoring the wellbore inclination with measurement data communicated from the ABI sensor. Inclination readings allow quick reaction to deviation, automatically correcting trajectory back to vertical. If the at-bit inclination increases above one degree, deflection is turned on automatically, tracking down to .7 degrees inclination. Deflection is automatically turned off as inclination drops below .7 degrees. This sequence continues to repeat to maintain verticality.

**MODEL-MEASURE-OPTIMIZE** – Expert ADT service engineers, LWD and petrophysical engineers, and directional drillers were assigned to monitor the job from the ROC. Using the proven philosophy of “model, measure, optimize”, ADT service specialists provided real-time data analysis for drillstring integrity, hydraulics management and wellbore integrity. Improved drilling performance was delivered by using all available downhole and surface measurements to establish the exact conditions at any point in the drilling process.

The Geo-Pilot XL system delivered the 17-1/2” section [from 812m (2,664 ft) to 1,810 m (6,938 ft)] of 998 m (3,274 ft) in 54.86 hours compared to the planned 360 hours, with an average rate of penetration of 18 m/hour (60 ft/hour). The interval was drilled with the inclination below 1 degree from 812 m (2,664 ft) to 1,544 m (5,066 ft). At this depth the inclination was observed to be 2.24 degrees, but the software quickly corrected the slope back to .44 degrees, where it remained for the remainder of the section. Drilling of the 12-1/4” interval followed using the same BHA configuration and vertical mode software, continuing to 3,230 m (10,597 ft), delivering a total of 2,658 m (8,720 ft) of vertical wellbore in two runs of the Geo-Pilot XL system.

**PEMEX SAVES US$ 1.4 MILLION** – The optimized drilling performance delivered by the Sperry team achieved the precise vertical wellbore placement required by PEMEX. Including time lost by waiting for supplies to the platform, (the semi-submersible drilling platform was located in a remote area where severe weather can sometimes hinder delivery of the required tools and services) using the Geo-Pilot XL system enabled the 2,658 m (8,720 ft) section to be delivered in 224 hours instead of the planned 360 hours. This saved PEMEX 5.6 days (136 hours), resulting in an estimated savings of US $1.4 million in platform costs. Future use of the drilling optimization solution with the Geo-Pilot XL system in vertical mode will now allow faster drilling in sections where verticality is required.