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ORIGINAL ARTICLE

A model on dual string drilling: on the road to deep waters

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Abstract
As the offshore market is facing the deepwater production challenges, the Oil and Gas Industry is investing in new technologies to bring down costs needed to effectively exploit reservoirs. Therefore, dual string drilling (DSD) can eliminate the marine riser which would result in exploring oil fields in deep and ultra-deepwater economically. In order for controlling fluid contact with a borehole wall during drilling operations include introducing an outer pipe into a borehole and positioning an inner pipe within the outer pipe axially. The method may further include circulating a drilling fluid to a drill bit using inner pipe and the annulus between the inner pipe and outer pipe. The drilling fluid may be separated from the control fluid by using an annular isolator. The results showed that with DSD approach a lot of time will be saved in order to circulate the kick out of the well. Apart from riserless drilling, DSD has an efficient cutting removal capacity, better annular clearance, elimination of differential sticking, better well stability, better well control parameters, reduction of torque and drag, avoid the dynamic equivalent circulating density gradient, and better extended reach drilling. The novelty of the new dynamics model is in the ability to solve narrow operational margin between pore pressure and fracture pressure as we move into deeper waters.

Keywords Riserless · Control fluid · Annular isolator · Equivalent circulation density · Well control

Introduction

Nowadays oil and gas industry is facing several problems as hydrocarbon reserves are declining and it's time to start exploring for new challenging areas, which represent a high economic risk, and technical problems. Deepwater drilling is one such challenging areas. Since increased target depth results in the narrower working window between formation pressure and fracture pressure, well-control aspect is becoming increasingly important in these challenging areas (Ouhibi et al. 2018). The kick tolerance margin is small for deepwater because of this narrower pressure window between pore pressure and fracture pressure. Another important problem with deepwater drilling is the narrower operating window as target depth increases (Frøyen et al. 2006).

For any drilling operation, early kick detection and circulation out of the well safely are therefore one of the major aspects of well control operations (Adams and Kuhlman 1994). As water depth increases for drilling operations, the size of both the marine riser and wellhead must increase to withstand severe stresses resulting from the weight of the riser with mud inside, surface and subsea water currents and the movement of a floating vessel (Smith et al. 2010). These factors, along with others, will increase the cost of the riser and wellhead as water depth increases, which will be an important factor for if the drilling operation will be economical.

The concept for a new riserless drilling with two drill strings has been explained in this work named as dual string drilling (DSD) with the aim of drilling in deep and ultra deep-water environments (Hannegan and Stave 2006). The technology has been fully scale pilot tested in 2016 and is regarded as a commercially available technology.

The DSD technology is a closed-loop drilling system, where the drill string (dual drill sting—DDS) has two separate flow paths. High-pressure mud (supply) is circulating down the DDS inner annulus, whereas the mud return is

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