

Automated Managed Pressure Drilling (MPD) System by @balance Services: Operator Avoids Hazards While Drilling Narrow Pressure Window in Gulf of Mexico

“The 12 wells on the SS 349 have all experienced difficult problems drilling in the rubble zone below the salt. The Automated MPD system was instrumental in solving the issues.”

Lonnie Reynolds, Sr. Drilling Engineer, W&T Offshore

THE SITUATION

Drill reservoir with a margin of only 1.2 ppg between pore pressure and fracture gradient. Avoid lost circulation and minimize ballooning. Prevent formation breakout due to cyclic pressure changes. Minimize swabbing while tripping out of hole.

THE SOLUTION

Install the @balance Services dynamic annular pressure control (DAPC) system, Coriolis flow-meter, and the HOLD rotating control device (RCD) to maintain near-constant bottomhole pressure on connections and early kick detection. Hold backpressure and strip out of hole to prevent swabbing.

THE RESULTS

Minimized rig time for rig up, testing, and tuning by rigging up offline prior to mill out. Services called online early to help control influx/loss cycle due to ballooning effect.

Automated MPD system by @balance Services provides near-constant bottomhole pressure to avoid losses and swabbing in depleted reservoir.

Proactive planning to mitigate drilling hazards

W&T Offshore planned to re-enter well SS 359 A5 through a window milled in 7¾-in and 9⅞-in casing, and by drilling a 6½-in hole to access hydrocarbon reserves in the target “P” sand. It was expected that the margin between the pore pressure and fracture gradient to be only 1.2 ppg.

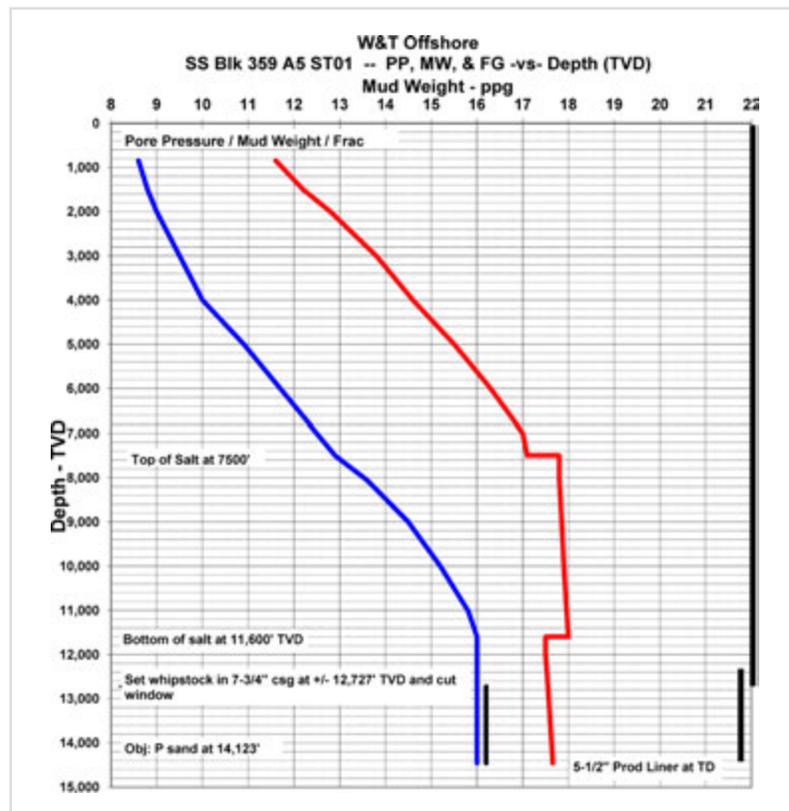


Figure 1: Narrow margin (1.5 ppg) between pore pressure and fracture gradient

Knowing the challenges that could be faced drilling through such a narrow mud weight window, W&T Offshore chose to employ a proactive MPD approach by using the @balance Services DAPC system to automatically manage the wellbore annular profile.

Early startup to operations

MPD operations were initiated sooner than planned as a result of gains and losses observed early in the hole section. Rigging up and pressure testing were conducted offline in order to minimize the impact on critical path rig time. Only minimal tuning and calibration were performed prior to starting MPD operations. Operator experience and hydraulics modeling were key factors to maintaining bottomhole pressure within a window of +/- 0.25 ppg.

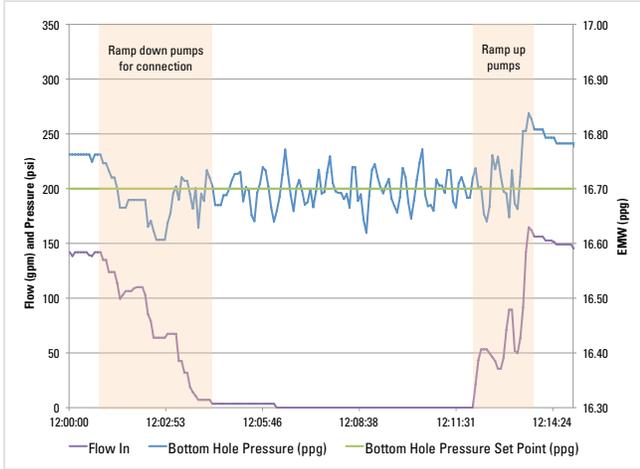


Figure 2: Response of the MPD system during a connection

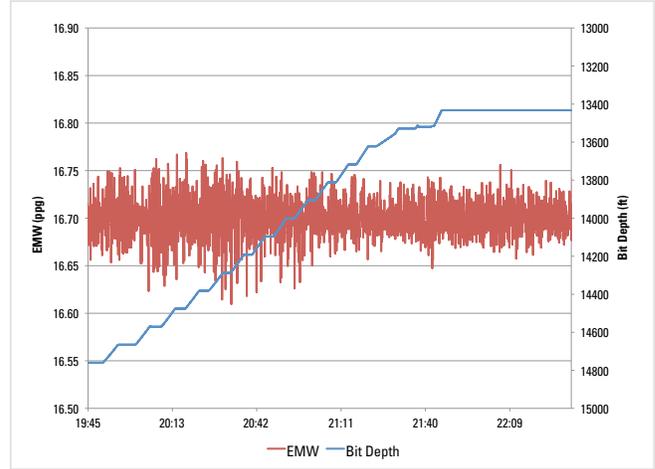


Figure 3: Near-constant bottomhole pressure while stripping out of hole

Avoiding swabbing

One of the concerns drilling the well was the risk of swabbing while tripping out of the hole. In order to mitigate this risk, a fixed backpressure was applied to the well and maintained by using a backpressure pump. Optimal selection of the backpressure and mud weight necessary for tripping required consideration of many factors, including whether the bottomhole pressure would allow for tripping in without surging and not exceeding the fracture gradient while the pipe was stationary with backpressure.

Effective planning and monitoring enabled the bottomhole pressure to be controlled within a window of +/- 0.1 ppg while tripping out of the well.

Equipment and services provided

Providing near-constant bottomhole pressure required several key components. The HOLD RCD allows for closed-loop circulation by diverting returns through the flow control system. The RCD is remotely operated from the rig floor promoting a safe working environment and ease in changing out sealing elements. The RCD is accompanied by a hydraulic power unit (HPU) to ensure adequate lubrication is provided to the bearing assembly and high pressure seals, and to maintain a positive pressure differential across the high-pressure seal section.

The @balance Services DAPC system provided control of bottomhole pressure within pre-set drilling windows through independent and/or simultaneous use of redundant chokes. The system actively controls the choke position, and can use its own dedicated pump to circulate mud and actively supply backpressure.

A Coriolis flow-meter is connected to the low pressure side of the choke manifold and provides flow out data that is continuously monitored and compared to flow in data for kick and losses detection.

Drilling engineering services by @balance Services provided a complete MPD drilling program and assistance in addressing the requirements of NTL 2008-G07 as required for MPD wells in the Gulf of Mexico. These services included hydraulics modeling, hazard identification and operability (HAZID/HZOP) workshops, and wellsite training to assure the competency of involved personnel.



Figure 4: @balance Services DAPC choke manifold



Figure 5: HOLD RCD on top of annular preventer

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