DEEP WATER

CASE STUDY

Combo MOTF and SSRV System Saves Casing Run in Deepwater Development

BAROID SOLUTION ENABLES OPERATOR TO REDUCE FLUID VOLUMES, CREATING SIGNIFICANT SAVINGS

LIBRA FIELD, BRAZIL

CHALLENGES

In offset wells, the operator encountered significant wellbore instability and hole cleaning issues, resulting in:

- Stuck pipe and premature section Total Depth (TD)
- Necessity for drilling and setting an additional remedial liner

SOLUTIONS

Halliburton proposed the combined use of:

- Mix On The Fly (MOTF) unit
- SUPER-SATURATED RISER-VIS™ (SSRV) Fluid Technology

RESULTS

- Achieved significant logistics savings due to reduced fluid volumes
- Successfully drilled post-salt section as one complete section, avoiding need for one entire casing string

CHALLENGES

SAVINGS

- ☑ 10 DAYS OF RIG TIME, USD 3M
- ☑ LINER AND CEMENT COST, USD 500K
- ☑ DRILLING FLUID COSTS, USD 1M

The pre-salt fields offshore Brazil rank as the largest deepwater oil reserves in the world. With reservoirs typically located at 19,700 feet to 22,950 feet (6,005 meters to 6,995 meters) below sea level, well construction costs are a critical factor in field development and investment viability. In this case, efficient well construction faced challenges in post-salt soft marine sediments and unconsolidated formations. Typical top hole well design was to drill riserless with seawater and sweep a 28-inch section as deep as possible, set a 22-inch casing, and then displace to a synthetic-based mud to drill and set an 18-inch x 22-inch section within the top salt. Drilling into the salt with seawater was not a viable option given the combined risk of hole enlargement from salt leaching and hole collapse from insufficient hydrostatic pressure.

In offset wells, while drilling a 28-inch section with seawater and viscous pills, the operator encountered significant wellbore instability and hole cleaning issues, resulting in stuck pipe and premature section total depth (TD), necessitating the need for drilling and setting an additional remedial 18-inch liner, thus accruing significant rig time and costs. In order to drill both the top hole and salt sequences in one drilling interval, a weighted drilling fluid is required. Ideally, using a salt-saturated system with densities greater than 10.3 lb/gal would allow the operator to drill the entire post-salt sequence as one complete hole section setting casing in the salt while avoiding salt leaching and hole enlargement issues around the casing shoe. The logistics and their costs, however, for this type of riserless drilling operation with conventional weighted water-based mud, made this an unattractive solution for long-term field development: to drill each top-hole section riserless required approximately 60,000 bbl of fluid, necessitating the need for multiple rig-support vessels for additional liquid storage.

SOLUTIONS

In close collaboration with the customer, and reflecting the strong desire to reduce well costs by drilling down to the post-salt as one complete hole section, Halliburton proposed the combined use of a Mix On The Fly (MOTF) unit and SUPER-SATURATED RISER-VIS™ (SSRV) fluid technology. Together, these would readily alleviate the logistical headache of pre-mixing and storing 60,000 bbl of weighted water-based mud. The SSRV is a highly concentrated, non-dispersed, salt-saturated 16-lb/gal slurry that can be quickly mixed with seawater and other brines to achieve the desired mud weight and mud volume. The MOTF facilitates the rapid shear mixing of different fluid feeds into a single, homogenous fluid stream. The unit

Using the combined Halliburton MOTF and SSRV solution, the operator was able to drill the post-salt sequence, and run and set casing without any impedance, restrictions or delays.

allows all inputs and outputs to be monitored and adjusted in real time ("on the fly") to achieve and maintain the desired output fluid characteristics such as density and viscosity.

For this case, two MOTF units were used in series, blending first a 11.5-lb/gal $CaCl_2$-brine with seawater and then mixing the resulting fluid with additional seawater and the 16-lb/gal SSRV to produce a 10.3-lb/gal water-based mud. Using this process, the operator only required 5,500 bbls of SSRV and 20,000 bbls of $CaCl_2$ brine to mix a total of 57,564 bbls of 10.3-lb/gal water-based mud, thus reducing storage volumes and associated logistics by more than 50 percent. Furthermore, the operator could drill the post-salt sequence, and run and set casing without any impedance, restrictions or delays.

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Figure 1 Mix On The Fly (MOTF) unit

Table 1: Total volumes pumped to the wellbore

57,564 bbl – 10/3 lb/gal using Pump and Dump Fluid Mixed			
MOTF #1 blend		MOTF #2 blend	
Fluid type	Total fluid mixed, bbl	Fluid type	Total fluid mixed, bbl
16-lb/gal SSRV	5,500	11.5-lb/gal $CaCl_2$ brine	20,064
Seawater	18,000	Seawater	14,000

RESULTS

The operator realized significant cost savings from using the combined Halliburton MOTF and SSRV solution. Not only was the operator able to achieve significant logistics savings from the reduced fluid volumes, but, more importantly, the operator was able to drill to the post-salt sequence as one complete section, removing one entire casing string and reducing the well architecture from five-hole to four-hole sections, thus providing substantial cost and time savings.

Savings included:

- 10 days of rig time: USD 3 million
- Liner and cement cost: USD 500,000
- Costs related to drilling fluids: USD 1 million

The combined MOTF and SSRV technology was essential to execute the riserless drilling plan for the post-salt sequence, allowing well architecture to be simplified to four-hole sections and thus optimizing well costs and substantially improving viability for this deepwater field development. Going forward, the operator is now planning to drill all its wells by using this technique and four-hole section architecture.

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