

# OFFSHORE / DEEPWATER DRILLING

## OVERVIEW



Designing and safely drilling offshore and deepwater wells requires a deep understanding of pore pressure, fracture gradient, and the often-narrow window between the two. The benefit of drilling a hydraulically stable hole is great both in terms of safety and economics. Risks such as shallow-flow hazards, kicks, losses, and borehole instability are therefore most critical in the deepwater domain. If not addressed, these hazards could lead to nonproductive time (NPT) in an environment where daily operational expenses often exceed \$1,000,000.

## CHALLENGES

### DRILL WITHIN TIGHT MARGINS

Determining and navigating the safe operating window

### MITIGATE LOST CIRCULATION AND KICKS

Managing the relationship between hydraulics and borehole geology

### ASSURE WELLBORE INTEGRITY

Understanding and managing the causes of borehole instability

### AVOID STUCK PIPE

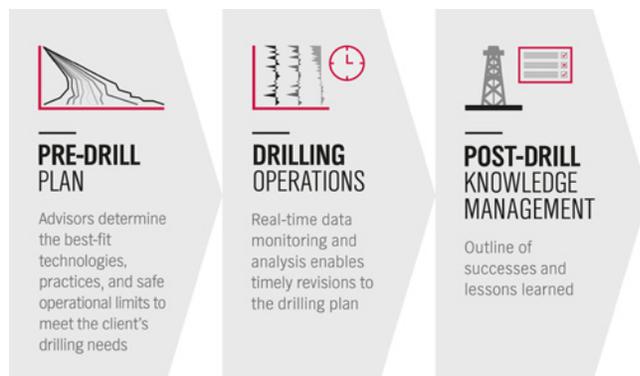
Reducing risk of stuck pipe and lost downhole tools

### MAINTAIN DRILLSTRING INTEGRITY

Monitoring key metrics to stay within safe operating parameters

## DRILLING INTEGRATED APPROACH

After recognizing the challenges and risks of offshore and deepwater drilling, the critical task is how to avoid, manage, and/or mitigate them. The Drilling Advisor solution - which combines drilling optimization, wellbore stability, and drilling hazard management - offers a proven methodology that is effective in all types of fields.





## PRE-DRILL PLAN

By analyzing historical well data to identify drilling hazards and to build geomechanics and drilling-optimization models, we create an enhanced drilling plan. Drilling within the appropriate margins (between the pore pressure, rock failure, and fracture gradient) helps to avoid kicks, losses, hole problems, and shallow-flow hazards that are prevalent in deepwater operations.

## DRILLING OPERATIONS

During drilling, industry-leading Weatherford products—from logging-while-drilling (LWD) tools to the MicroFlux® managed pressure drilling (MPD) system - provide valuable downhole feedback that facilitates drilling hazard management analysis. Real-time monitoring through our Virtual Well Monitoring® service enables our team to identify deviations between models and actual drilling data. This comparison provides situational awareness of possible drilling hazards before they happen, and enables us to make appropriate adjustments as necessary to minimize NPT.

## POST-DRILL KNOWLEDGE MANAGEMENT

Finally, our knowledge management process captures the lessons learned in an end-of-well report that outlines key performance indicators (KPI), details opportunities for improvement, and makes recommendations for future projects.

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## TECHNOLOGIES

Technology is at the heart of our approach to meeting clients' needs. We constantly update and refine our technologies to solve new challenges encountered in the field.



### MICROFLUX® CONTROL SYSTEM

The Microflux managed pressure drilling (MPD) control system enables real-time detection and control of minute downhole influxes and losses to minimize NPT spent managing well-control issues. This technology has been used extensively in deepwater fields, including the pre-salt fields of offshore Brazil and West Africa. MPD techniques can be incorporated into the well design to address downhole challenges beyond the capabilities of conventional technology, and to improve drilling efficiency and well integrity.

<http://www.weatherford.com/en/products-services/drilling-formation-evaluation/secure-drilling-services/managed-pressure-drilling/microflux-control-system>



### SWAGEHAMMER™ INTEGRATED LINER-HANGER SYSTEM

Deepwater wells require reliable liner systems capable of withstanding extreme pressures and temperatures. The SwageHammer system eliminates leak paths and other common points of failure to form a gas-tight seal for the life of the well.

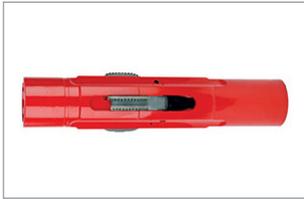
<http://www.weatherford.com/en/products-services/well-construction/liner-systems>



## VARIFORM® CENTRALIZER

The robust VariForm centralizer is able to withstand demanding run-in conditions and provides maximum standoff during cementing operations in a wide variety of wellbore profiles. It enhances the quality of the cement job and promotes life-of-well integrity.

<http://www.weatherford.com/en/products-services/well-construction/cementing-products/centralizers>



## RIPTIDE® RFID DRILLING REAMER

Commonly, when drilling in deep water, there is a need to enlarge the hole beyond the previous casing diameter to run a subsequent string. In these cases, the RipTide reamer provides a flexible, efficient solution. RFID activation means that the reamer can be opened and closed multiple times and can ream different sections of the hole during a single trip.

<http://www.weatherford.com/en/products-services/well-construction/drilling-tools-and-rental-equipment/performance-drilling-tools/riptide-drilling-reamer>



## LANDING STRING STRIPS (LSS) 1250

The remotely-operated LSS 1250 enables safe handling of heavy, deepwater landing strings from the driller's cabin. In 2015, this tool enabled Weatherford to land a 1,180-ton (2,360,700-lb) casing string in the Gulf of Mexico - a world record. It is now rated to handle up to 1,500 tons.

<http://www.weatherford.com/en/products-services/well-construction/tubular-running-services/rig-system-services>

## CASE STUDIES

The combination of our industry-leading technologies and our disciplined approach has produced measurable value for our clients.



### MICROFLUX SYSTEM REVIVES PRE-SALT WELL

<http://www.weatherford.com/doc/wft266871>



### VARIFORM CENTRALIZERS SET LINER IN GOM WELL

<http://www.weatherford.com/doc/wft298566>



### RIPTIDE REAMER ENLARGES WELLBORE IN 1 TRIP

<http://www.weatherford.com/doc/wft283535>



### LSS 1250 SAVES \$15 MILLION

<http://www.weatherford.com/doc/wft298716>



### HEATWAVE EXTREME SERVICE LOGS 22 OFFSHORE WELLS

<http://www.weatherford.com/doc/wft309063>