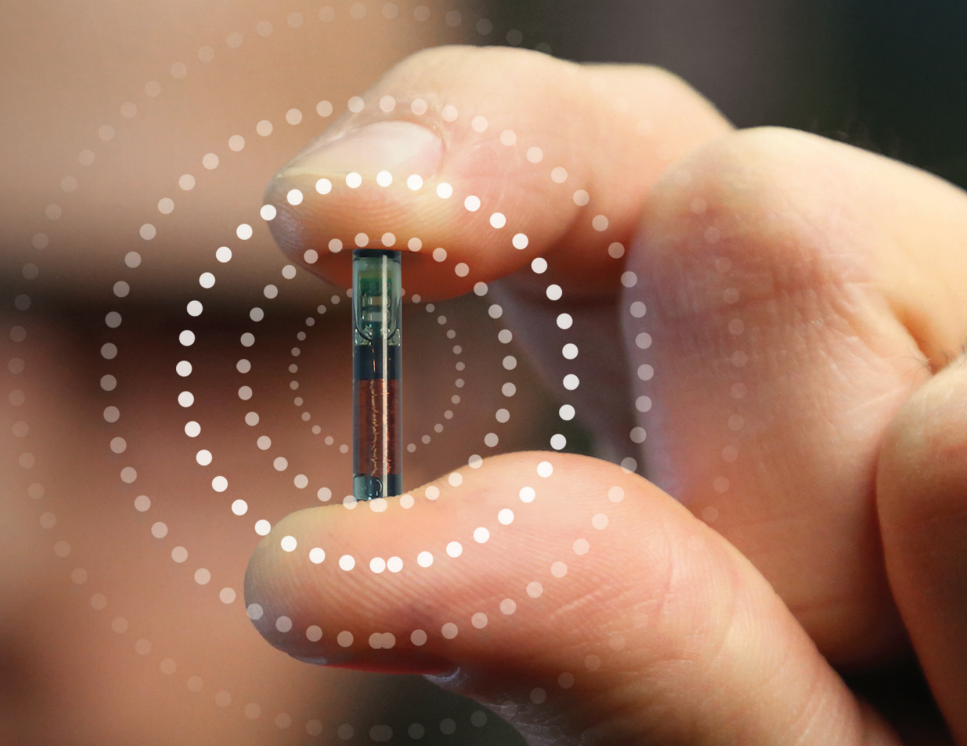


COMPLETIONS

# RFID-ENABLED TOOLS

Delivering efficiency, flexibility,  
and control in challenging  
downhole environments



**Weatherford**<sup>®</sup>

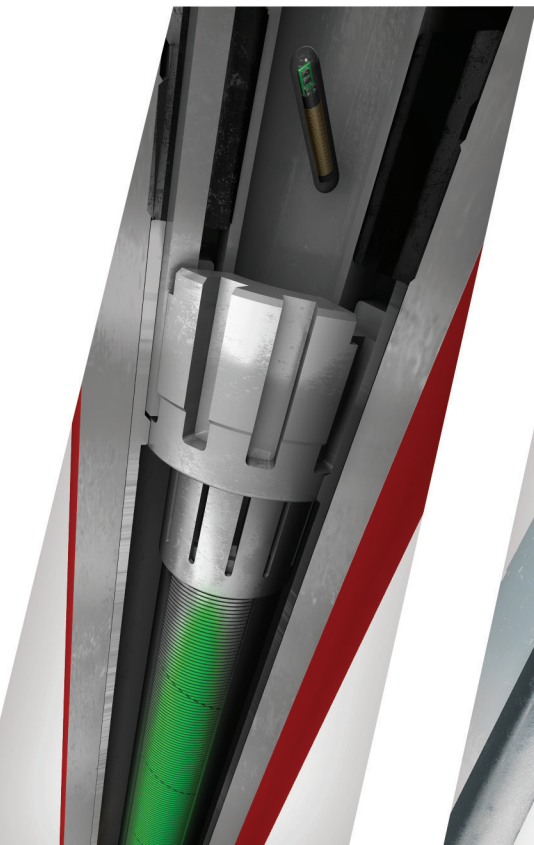
# ACTIVATE THE POSSIBILITIES

It just makes sense. Used for common applications across diverse industries and even for everyday tasks, radio-frequency-identification (RFID) technology achieves real business benefits in the oilfield.

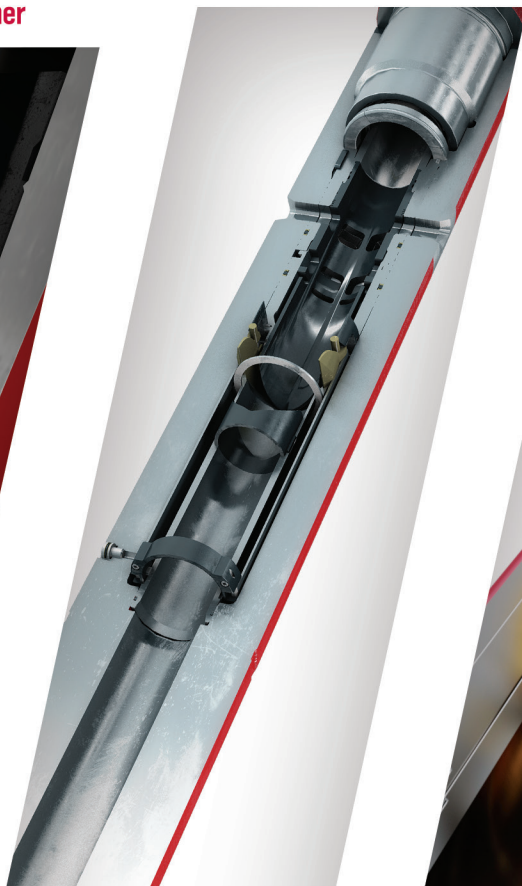
Weatherford pioneered the use of this proven technology in downhole tools to expand your capabilities in drilling and completion operations—particularly in challenging environments such as offshore, deepwater, and high-rate, onshore gas wells. In fact, we are the oil and gas industry's sole provider of downhole tools enabled by RFID technology.

Our game-changing technologies give you a new way to activate your tools and accomplish your objectives. Unlike conventional tools that use ball-drop activation, RFID-enabled tools have full-bore inside diameters (IDs) with no restrictions to hamper flow, impede future operations, or block the actuation of other equipment down the line. With different positions, multiple applications, and dynamic activation options, our RFID-enabled tools give you the power to simplify operations, increase efficiency, enhance flexibility, and take control. As a result, you have the potential to reduce operating costs by millions of dollars.

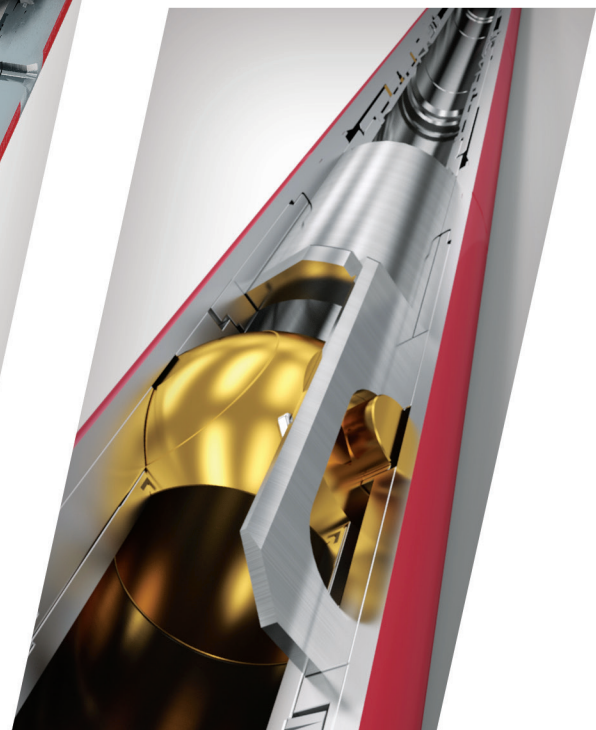
> **RipTide® Drilling Reamer**



> **JetStream® Circulation Sub**



> **OptiBarrier™ Ball Valve**





### Increased Efficiency

We help you get more done in less time or in fewer trips. RFID technology lets you activate your tools an unlimited number of times—without requiring you to pull out of the hole. Whether you need single-trip drilling and reaming with unlimited activations, intervention-free completion installations, or the capability to reverse cement an offshore liner, our full-bore RFID-enabled tools get the job done faster.



### Enhanced Operational Flexibility

We bring the power of choice to your wellsite. RFID technology lets you choose which tools to run, where to place them in the toolstring, and in what order to actuate them. By removing balls, seats, and milling requirements, our RFID-enabled tools eliminate mechanical restrictions, are simple to operate, and work well with other equipment. These tools will not interfere with wireline operations or ball drops to other tools, and they will not limit the performance of logging-while-drilling (LWD) or rotary-steerable systems—regardless of where they are placed.



### Greater Downhole Control

We make operations in challenging environments more reliable. RFID technology lets you control multiple RFID-enabled tools in a single string—and selectively target and actuate individual tools as needed. Compared to conventional ball-drop methods, these tools also offer multiple trigger options for improved reliability in responding to downhole problems.

## HOW RFID TECHNOLOGY WORKS

- 1 An RFID tag is preprogrammed at the surface.
- 2 The RFID tag is pumped downhole from the rig floor.
- 3 As it flows by, the RFID tag emits electronic commands to the antennae on specific tools along the toolstring.
- 4 The tools activate or deactivate on demand, without requiring any equipment to be pulled out of the hole. RFID tags can communicate with individual or multiple tools—and in any order.
- 5 RFID-enabled tools have onboard memory capabilities that record downhole events and tool status.



Our RFID-enabled tools allow for multiple activations—but this capability isn't limited to using RFID tags. As an alternative, our RFID-enabled drilling tools offer pressure-cycle activation and our RFID-enabled completion tools offer pressure-cycle activation, timers, or the use of both in combination with RFID tags. The result is flexible and reliable tool activation when you need it most.

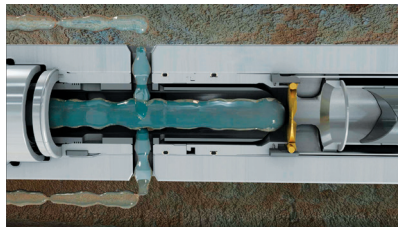
	 RFID	 BALL DROP
--	--	---

Milling required		●
Monobore completion	●	
Back flow of balls		●
Coil tubing required		●
Timing of balls		●
Risk of over displacement	N/A	High
Screen-out contingency	●	
Clean-out barrier	●	
Positive indication of reservoir communication	●	
P/T data logging	●	
Flexible operational logic	●	
Surge from pressure event		●
Allows larger ID	●	
<b>Frac cycle time (hr)</b>	<b>12</b>	<b>114*</b>

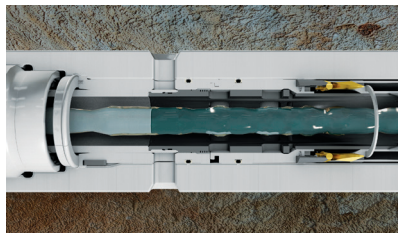
\*SPE 181265

FEATURED RFID-ENABLED

# DRILLING AND COMPLETIONS TOOLS



Open



Closed

## JetStream® RFID Circulation Sub

Many circulation subs can clean wellbores, spot remediation fluids, and jet blowout preventers—but not all three in one trip. Most circulation subs also rely on ball-drop activation. The JetStream RFID circulation sub is different.

Because RFID technology places no limit on the number of tags that can be dropped and therefore no limit on the number of actuations, you can use a single JetStream sub as many times as needed to execute multiple operations without tripping out. Each RFID tag pumped downhole Commands the sub to switch between open and closed positions, which makes redirecting fluid flow incredibly easy.

The JetStream sub has no bulky internal components that can impede running multiple tools, so you can run as many as 16 subs at once. The capability to run multiple JetStream subs in tandem—with subs located at different, strategic positions along the drillstring—gives you additional functionality and flexibility.



Gulf of Mexico

RIPTIDE AND JETSTREAM TECHNOLOGIES

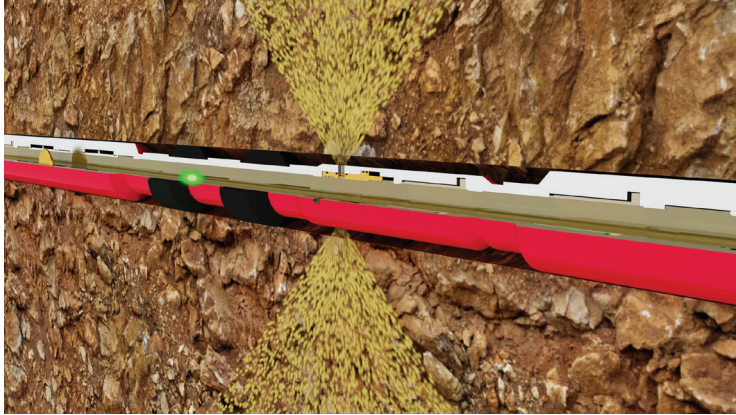
**SAVED 3 DAYS OF RIG TIME  
VALUED AT US \$1 MILLION**



### **RipTide® RFID Drilling Reamer and RipTide Rathhole Killer® Drilling Reamer**

Our RipTide RFID drilling reamer, which enlarges holes by up to 25 percent beyond bit diameter, can run in tandem with the RipTide Rathhole Killer drilling reamer to double your reaming capabilities. RFID technology enables unlimited activations and deactivations—and full independent control—for each drilling reamer at any time within the same trip for maximum operational efficiency.

When jarring to work past tight spots, the cutter blocks of conventional reamers can be unintentionally activated. Both RipTide RFID drilling reamers activate and deactivate only on command to prevent accidental activation, which reduces the risk of sticking and associated nonproductive time, and keeps you on schedule.



## AutoFrac® Stimulation System

The AutoFrac system enables efficient, intervention-free stimulation of openhole sections in extended-reach, offshore wells in which conventional technologies are not as reliable and have limited contingency options. RFID technology remotely operates lower-completion tools and provides several backup tool-communication options that do not rely on control lines or mechanical actuation. This flexibility enables the system to continue functioning in a variety of scenarios—even a full screenout. The intervention-free operations made possible by RFID technology shorten fracture-to-fracture cycle times, minimize trips in and out of hole, and reduce on-site personnel and equipment.

Remote control via RFID tags also eliminates the need to set and mill out plugs or ball seats. AutoFrac system components include the AutoStim flapper valve, which remotely opens and closes to provide on-demand zonal isolation and proppant diversion. This capability removes the need for risky, costly, and time-consuming milling operations and leads to faster production. It also enables sequential opening from the toe to the heel for enhanced well cleanup.



North Sea

AUTOFRAC SYSTEM

**STIMULATED 7 ZONES INTERVENTION FREE  
AND SAVED US \$15 MILLION COMPARED TO  
CONVENTIONAL METHODS**



### **i-Stim® Stimulation Sleeve**

Ball-drop completion tools can place restrictions on running multiple tools. The i-Stim stimulation sleeve relies on pumped RFID tags for activation, so there's no realistic limit to the number of sleeves you can run in a single well. You can strategically place and reliably operate multiple i-Stim sleeves at once—even in extended-reach wells from the toe to the heel. And with no balls or seats, you can achieve a monobore ID with nothing to mill out at the end of the job.

With the independent, remote opening and closing capability of the i-Stim sleeve, you can access discrete zones—in any order—for targeted stimulation operations. The i-Stim sleeve also enables isolating and testing completions. The lower completion becomes the reservoir barrier and fluid-loss device, which eliminates the need for an intermediate completion. At depth, you can open the tools in order with no intervention required.



### **RFID Annular Safety Valve**

The RFID annular safety valve (ASV) provides a reliable means of isolating gas in the lower annulus—without incurring high intervention costs or significantly impacting your schedule. In fact, the RFID ASV is particularly suited for remote wellsites to which transporting workover rigs and intervention equipment would be too costly, or wells in which mechanically installing pressure-control equipment is too risky or time consuming. Instead, you have the option to set the RFID ASV efficiently using an RFID-enabled hydraulic communications sub. In addition to saving time and reducing installation costs, the RFID ASV requires fewer specialized personnel on site and enhances safety.



Caspian Sea

RFID ASV

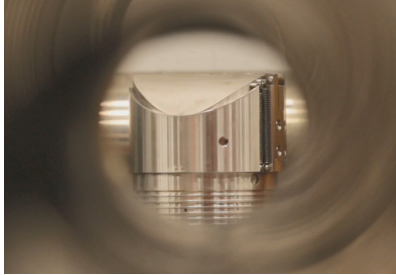
**ELIMINATED INTERVENTION RUNS AND REDUCED  
COMPLETION TIME IN 33 DEEPWATER WELLS  
AND SAVED US \$25 MILLION**



## FEATURED RFID-ENABLED DEEPWATER SOLUTIONS

The high costs of deepwater operations demand cost-effective and efficient solutions to drilling and completion challenges. RFID-enabled technologies reduce overall operational time and deliver more flexibility and control.

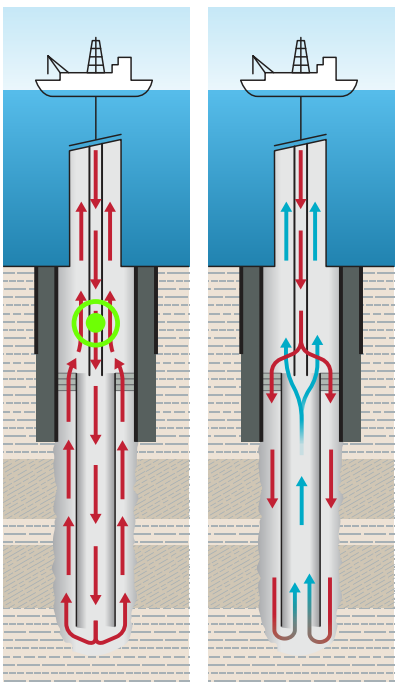




### RFID DDV<sup>®</sup> Downhole Deployment Valve System

When you want to drill in deepwater, explore carbonate reservoirs with large vugs, and run long liner strings in one go, Weatherford provides the pressure control to do it. We joined forces with ENI to develop the non-umbilical DDV downhole deployment valve system—an unrivaled RFID-enabled system for downhole isolation in offshore environments that eliminates the need for control lines and heavy mud.

Control lines make it almost impossible to work in deep water, and heavy kill mud can damage the formation and diminish future recovery. Unlike traditional isolation methods, the RFID DDV system provides isolation without these things to enable conventional tripping during drilling or casing. The controlled isolation maximizes the benefits of managed pressure drilling, boosts overall productivity, reduces costs, enhances safety, and delivers reliability during operations.



**Left:** Conventional flowpath disrupted by RFID tag

**Right:** Reversed flowpath after crossover tool is activated

### CrossStream<sup>™</sup> RFID Subsurface Reverse-Cementing System

In any well, it's critical to operate efficiently without sacrificing well integrity. This is especially true for high-cost, high-risk wells such as fragile deepwater formations. In conventional cementing operations, the high equivalent circulating density (ECD) required to push cement down the liner and up the annulus can fracture these formations, resulting in poor cement quality.

The CrossStream subsurface reverse-cementing system provides selective cement placement when you need to reduce bottomhole ECDs and protect formations while cementing liners in offshore environments. RFID tags command the system components to shift between a conventional flow path for running in hole or setting a liner hanger, and a reverse flow path for cement placement. In this system, an RFID-activated crossover tool diverts cement from the workstring directly into the liner annulus. Returns are taken up the liner ID and are then diverted back through the crossover tool into the upper annulus. This system increases cementing efficiency and allows for ultimate flexibility in responding to changing conditions in sensitive wells.

## TR1P™ Single-Trip Completion System

High rig costs drive the need for reduced trips in hole, particularly in deepwater environments. The ability to perform multiple operations in less time and with fewer equipment and personnel requirements sets the stage for tangible benefits.

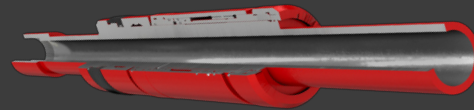
As the world's first and only remote activated, single trip deepwater completion system, the Weatherford TR1P system establishes a new precedent in completion installations. By enabling you to install the upper and lower completion in just one trip, the system simplifies your operations and reduces your completion installation times by as much as 40 percent.

This game-changing deepwater solution overcomes the barriers to adopting single-trip systems by combining RFID technology and elements from our premium completions technologies into one. The result is a completion system that eliminates the need for control lines, wash pipe, wireline, coiled tubing, wet-connects, and workover rigs for a 100-percent interventionless operation that reduces deployment risks. This remote, intervention-free capability enables you to perform the operations demanded by your reservoir—rather than your budget—in both producer and injector wells.

The TR1P completion system incorporates approximately 40 premium-quality components, many of which are RFID activated.



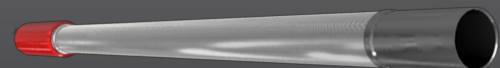
**Optimax™ tubing-retrievable safety valve** shuts in the well with a gas-tight seal in the event of uncontrolled flow.



**Intelligent completion packoff element** enables zonal isolation for completions that require multiple-line bypass.



**RFID Optibarrier™ ball valve** controls wellbore flow as a reliable downhole barrier.



**RFID inflow control device** provides interventionless uniform inflow and outflow distribution.

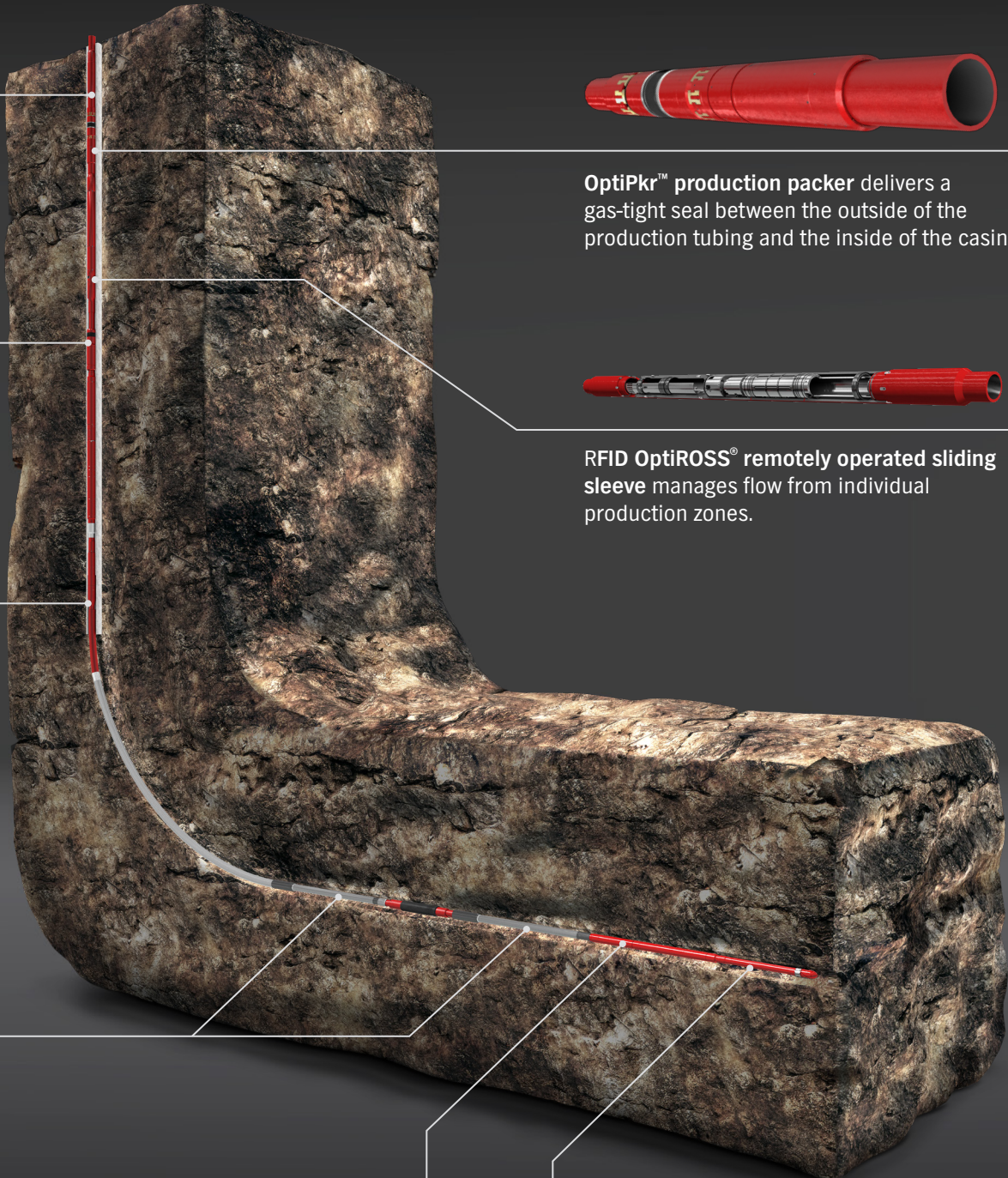


Nigeria

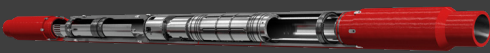
## DELIVERING REAL SAVINGS TO CUSTOMERS

In an ongoing field test that spans 22 wells for a deepwater oil and gas producer in Nigeria, the TR1P system saved 4 operating days compared to a two-trip upper and lower completions process. The customer projects a total savings of approximately US \$200 million\* for the entire campaign.

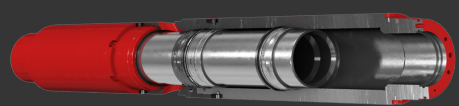
\*Cost savings as provided by the customer



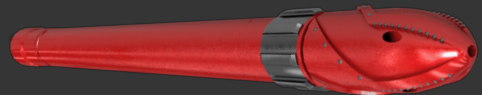
**OptiPkr™ production packer** delivers a gas-tight seal between the outside of the production tubing and the inside of the casing.



**RFID OptiROSS® remotely operated sliding sleeve** manages flow from individual production zones.



**RFID reservoir isolation valve** provides a cost-effective, debris-tolerant means to isolate the completion system.



**Hydraulic reaming shoe** makes reaching your target depth quick and easy.



## ACTIVATE THE POSSIBILITIES IN YOUR WELLS.

---

Our incorporation of RFID technology into a variety of drilling and completions tools has the potential to transform your operations—even in the most challenging environments—by delivering more efficiency, flexibility, and control, along with the potential to reduce operating costs significantly.

[WEATHERFORD.COM/RFID](http://WEATHERFORD.COM/RFID)

### CONNECT WITH WEATHERFORD

---



© 2018 Weatherford. All rights reserved. 12650.01