Hammerhead Ultradeepwater Integrated Completion and Production System

Improve recovery and minimize risk in frontier plays
Ultradeepwater plays represent one of the largest development opportunities in the world…

…but the challenges are just as great.

An estimated 13% of new source production is expected to come from ultradeepwater plays in the Gulf of Mexico. But the disparity between today’s “conventional” deepwater completions technology and what is needed for these frontier developments is very pronounced. Ultradeepwater conditions are extreme; formations are tight, and wells must produce high volumes, for decades, to remain economical.

*Source: Rystad Energy
In addition to the technical challenges, Lower Tertiary reservoirs have low permeability and will require unprecedented levels of stimulation to unlock hydrocarbons. And, until now, integrated systems designed for ultradeepwater conditions and production demands have been nonexistent.

With staggering development costs and a lack of available fit-for-purpose, integrated technology, accessing and producing these reservoirs represents a considerable risk for operators—one that can even outweigh the potential reward.

Lower Tertiary, Gulf of Mexico: Technical challenges

- Water depths: 5,000 to 10,000+ ft (1500 to 3000+ m)
- Reservoir depths: 25,000 to 33,000+ ft (7500 to 10 000+ m) total vertical depth
- Bottomhole pressures: ≤ 25,000 psi (1700 bar)
- Bottomhole temperatures: ≤ 300°F (150°C)
- Economic production requirements: 20,000 to 30,000 barrels of oil per day (BOPD) for 20+ years

But for every 1% increase in recovery from Lower Tertiary reservoirs, operators can increase returns by approximately USD 2+ billion.*

*Based on USD50 per barrel
Supported by Baker Hughes advanced stimulation vessels, the Hammerhead system’s multizone single-trip frac-pack tool can deliver high-rate, high-volume treatments into five zones for maximum reservoir connectivity.

Questions around risk and return on investment (ROI) are central to every development. But when an operation will take place in uncharted territory, and it will draw on a portfolio of unsuitable and/or incompatible technology and require hundreds of millions of dollars in up-front CAPEX, the decision on whether or not to proceed can become very daunting. The risks, both operational and economic, can seem too great.

**But with the right engineered-for-purpose system, operators can now develop ultradeepwater plays with confidence.**

The Baker Hughes Hammerhead™ system is the industry’s first integrated completion and production system that allows operators to access Lower Tertiary reservoirs and maintain long-term production, safely and reliably, for full-field economic payback.

Much of the research and design work for the Hammerhead system occurred at the Baker Hughes Center for Technology Innovation (CTI), located in Houston, Texas. The CTI facility—which is capable of testing up to 40,000 psi (2760 bar) and 700°F (370°C)—was critical in validating specifications of every component.
Fully assembled, the Hammerhead system includes an upper completion, a lower completion, an isolation assembly and intelligent production capabilities, and is fully compatible with subsea boosting for increased recovery.

**Improve safety and reliability**

The Hammerhead system encompasses a new portfolio of technology specifically designed for reliable long-term operation in conditions up to 25,000 psi and 300°F. Developed using a holistic, wellhead-to-reservoir engineering approach, it offers total integration and full compatibility of all parts. This system-based approach reduces operational risk, and also eliminates the burden of multi-vendor integration.

Proppant at up to 50 bbl/min, into as many as five zones. These aggressive treatment capabilities help to ensure optimal reservoir connectivity and conductivity for increased hydrocarbon flow. Completion design, placement, and fracture design are optimized through comprehensive modeling from our reservoir development service team. Industry-leading differential pressures up to 15,000 psi (1030 bar), combined with subsea boosting technology, help to reduce abandonment pressures for maximum reservoir drainage. The system’s lower completion features a 5¾-in. minimum production inside diameter (the industry’s largest for a high-pressure 8½-in. drift completion), thus allowing it to handle flow rates up to 30,000 BOPD over the life of the well for improved recovery rates.

The system’s frac-pack tool increases reliability and simplifies operations through positive indications that enable greater set-down weight and higher up-strain. HSE risk is significantly reduced through an ultra-durable mechanical barrier that maintains reliable well control during the upper completion installation, and throughout a production life of 20+ years. Additionally, remote surveillance and control capabilities allow operators to identify and mitigate potential issues before they occur.

**Maximize production**

The extreme pump rates and volumes required for effective stimulation of Lower Tertiary reservoirs typically extend beyond the reliable operating range of almost all available tools, fluids, and vessels. But the Hammerhead system’s frac-pack tool—designed and tested for extreme rates, pressures, and temperatures—can deliver as much as 5,000,000 lb (2,268,000 kg) of proppant.
Optimize performance and improve recovery

Once connected to the reservoir, the Hammerhead system allows operators to optimize production by using proactive reservoir management capabilities.

Monitoring technology, including distributed temperature sensing fiber optic cables and electronic pressure and temperature gauges, can be placed inside the lower completion and then brought online via downhole wet-mate technology.

A continuous stream of real-time data allows for 24-hour surveillance—and dual-choking, hydraulic intelligent well system valves enable selective zonal control to enhance production.

Flow assurance technology can also be delivered as needed via chemical injection valves in order to avoid costly production interruptions and ensure reliable, sustained hydrocarbon flow throughout the well’s life cycle.
In 2012, Baker Hughes announced the creation of our Lower Tertiary Integrated Product Team (IPT)—an integrated cross-functional group dedicated to expanding the ultradeepwater technology envelope. The IPT’s first mission: design and deliver the Hammerhead system.

The development process for the Hammerhead system started with validating design and scope through customer feedback. The system would be engineered-for-purpose based on the wants and needs of the customer. Collaboration continued throughout every phase of development, ensuring that the final product would meet, and even exceed, their expectations.

Operating outside of the typical business model for product development, the IPT enabled rapid engineering design and development of the system and shortened manufacturing lead times, accelerating the system to market in 50% less time.

With the Hammerhead system, operators now have the ability to safely access and economically produce ultradeepwater plays. Contact your Baker Hughes representative today or visit www.bakerhughes.com/Hammerhead to learn more about how our integrated system can help you improve recovery factors and maximize returns in frontier applications.

Industry’s first integrated ultradeepwater system
- Withstands conditions \( \leq 300^\circ F \) and \( \leq 25,000 \) psi
- Provides reliable operation for 20+ year completion well life
- Enhances reservoir stimulation for maximum production
- Maintains long-term production rates of 20,000 to 30,000 BOPD
- Offers higher drawdown capability for increased reservoir drainage
- Provides incremental 2% recovery to natural flow
- Increases ROI

Closing the frontier technology gap:
A new approach to integration and collaboration

The introduction of the Hammerhead system marks the first of many ultradeepwater solutions to be developed using this holistic, customer-driven approach. Contact your local Baker Hughes representative today to learn more about upcoming additions to our portfolio of BlueWave™ integrated offshore frontier solutions.