

**Case study:** Lower Tertiary formation, Gulf of Mexico

# MST completion system saved up to \$12 million USD in IWS ultra-deepwater well

An operator with a deepwater field development in the Lower Tertiary formation in the Gulf of Mexico chose to use the Baker Hughes multi-zone single trip (MST) completion system to execute three frac-pack treatments in one run. The MST system efficiently treats multiple zones in one trip, providing significant cost savings and reducing nonproductive time (NPT) compared with conventional technology, which requires at least one trip for each frac-pack treatment.

The well was drilled to 27,460 ft (8370 m) total depth (TD) in 8,149 ft (2484 m) of water, and 10 1/8-in. casing was installed. The well intersected three pay zones. After perforating, the operator ran the Baker Hughes MST system, comprised of a 96-37 service tool with dual shifter configuration, MST screens with a patented screen communication system (SCS), multi-service valve (MSV) sliding sleeves with selective profiles, and isolation packers.

**InQuest PayZonePro™ software** was used to model downhole hydraulic forces acting on the service tool to ensure sufficient set-down weights for all stages of the operation. The MST system has positive locating mechanisms that fit together to confirm service tool positioning downhole and features high set-down capabilities and designated seals to handle high pressure frac operations. The service tool is engineered to endure high pressures and high treatment rates at varied concentrations. It is also designed to pump the large proppant volumes associated with multiple zone stimulations.

After the zonal isolation packers were simultaneously set and tested, the service tool was positioned at the lowermost zone to perform the frac-pack stimulation. Upon completion of the treatment, the service tool was repositioned to close the monitoring sleeve and the frac sleeve in one upward movement. The dual shifter configuration optimizes the operation by reducing rig time, while also reducing the risk associated with excessive tool manipulation. The zone was pressure tested to confirm well integrity and the same process was followed for the second and third zones.

The frac-pack operation used 8 PPA of high-strength proppant pumped at 32 bpm with a surface treatment pressure of 13,000 psi (896 bar). After all three zones were successfully treated with over 1 million lbm of proppant, the service tool was inspected and confirmed to be in good condition.

The 5,000 ft (1524 m) isolation string—consisting of an **SC-XP™ V0-rated intermediate isolation packer, selective shifting tools, a tubing isolation ball valve, and a recloseable annular flow valve (X-AFV)**—was successfully deployed. The X-AFV is opened and closed using hydraulic input, and includes a contingency option for mechanical manipulation if needed. The SC-XP packer features our proven **ZX™ seal element** which resists swab-off, and is designed for use in deepwater HP/HT environments.

The production sleeves were opened and the isolation SC-XP packer was set and tested. The intelligent well system

## Challenges

- Operator needed to efficiently stimulate three zones and produce via intelligent completion
- 27,460-ft TD deepwater well in 8,149 ft of water
- 19,000 psi reservoir pressures

## Results

- Saved operator 12 days rig time and an estimated \$12 million USD
- Executed operation with zero HSE incidents
- Reduced risk through pre-job modeling
- Significantly increased expected production

(IWS) upper completion—consisting of 4½-in., 12,000 psi (827 bar) **InForce™ HCM-Plus hydraulic sliding sleeves**, a 10,000 psi (689 bar) **Premier™ packer**, a Venturi flow meter, pressure and temperature gauges, and chemical injection valves—was installed to facilitate interventionless production of the two upper isolated zones. The well was successfully put into production by opening the tubing isolation valve for the upper section (included the two upper zones) and the X-AFV for the lower section (included the deepest zone).

The efficiencies gained through the use of the MST system enabled the operator to start production 12 days sooner than would have been expected with a conventional frac-pack completion, saving an estimated \$12 million USD considering rig time alone. Initial tests on the well confirmed significantly higher production rates than expected.