



TESTING TIMES

A field engineer prepares the Quartet string for a reservoir test.

Emmanuel Delvaux, Schlumberger Testing Services sales and marketing manager for the Middle East, explores how technology is enabling better field development decisions

Reservoir testing involves measuring reservoir pressure, metering flow rates, and taking representative samples of reservoir fluids in a well. Testing is frequently performed in newly drilled wells with hydrocarbon shows, and may also be applied after stimulation activities or after significant changes appear in the composition of produced hydrocarbons.

Information provided by testing is essential for discovering boundaries, faults, and fractures; identifying strategies to improve well and field performance; confirming volumetric reserve estimations; and designing suitable surface production facilities. Analysis of the reservoir fluid samples provides details about chemical composition and gives clues about potential production

problems such as wax, hydrate, or asphaltene deposition.

Schlumberger has been building expertise in the Middle East

area to develop metallurgies, processes, and tools capable of capturing representative hydrocarbon samples despite highly

“The CERTIS system is the first of its kind: a retrievable test system that delivers production-level isolation”

reactive downhole conditions. Many wells in the region—particularly gas producers—exhibit high pressures, high temperatures and very high concentrations of hydrogen sulphide (H₂S). In addition, the reservoir fluids often contain trace elements that must be accurately quantified, including reactive and potentially hazardous chemicals such as mercury.

Recently Schlumberger introduced the Quartet high-performance downhole reservoir testing system, and is deploying it in a diverse range of oil and gas fields around the world. This new technology delivers high-resolution deep-reading pressure measurements and contaminant-free representative fluid samples from deep within the reservoir—all in a single run—with maximum safety and efficiency. The system offers non-reactive technologies capable of operating effectively in harsh well conditions, and provides operational efficiencies that can reduce rig-time and reduce risk.

ABOUT THE AUTHOR:

Emmanuel Delvaux is the Schlumberger Testing Services sales and marketing Manager for the Middle East. Before assuming this role in 2008, Delvaux was the Testing Services GeoMarket manager based in Qatar. He has 15 years experience with Schlumberger Testing Services. Delvaux started as a project engineer in France before taking several managerial technical and sales positions in Libya, Norway and several countries in the Middle East. Delvaux received his MSc in advanced manufacturing systems from Kingston-upon-Thames University. He is a member of SPE.

A SHORTER, SIMPLER, ONE-TRIP SOLUTION

The new downhole reservoir testing system has been engineered to provide a complete test string, applied as part of a fully integrated service that allows operators to get everything they need in a single trip. The rugged tool string is four times shorter than a conventional tool string. The elimination of drill collars and slip joints translates to greater reliability, safety, and deployment efficiency. Tools are joined using premium connections to ensure hydraulic integrity. Compared to conventional downhole test string configurations, the new system's efficiencies include a 35% lower tool operating pressure, 90% less nitrogen, 50% fewer seals, and 60% fewer connections.

The system can be used to simultaneously deploy high-performance perforating gun strings below its production-quality packer; users can set the packer, perforate, test, and retrieve the test string in a single run. The system also provides the option to place a below-packer circulating valve on the test string for a more efficient well kill; especially important when testing gas wells.

INTEGRATING FOUR ADVANCED TOOLS

The Quartet system combines four leading downhole technol-

ogies—each of which has been field-proven in the Middle East and around the world—engineered specifically for reservoir testing: the CERTIS high-integrity reservoir test isolation system, the IRDV intelligent remote dual valve, the CQG crystal quartz gauge, and SCAR inline independent reservoir fluid sampling. This combination provides unique benefits suited to some of this region's harsh well conditions.

HIGH-INTEGRITY RESERVOIR ISOLATION SYSTEM

The CERTIS system is the first of its kind: a retrievable test system that delivers production-level isolation. Combining the features of a retrievable drillstem test packer with a hydraulically set permanent packer, the high-integrity reservoir test isolation system eliminates the need for drill collars and slip joints. Annulus pressure activates the packer, so no rotation or mechanical setdown weight is required. This is especially important in deepwater or horizontal wells, where applying precise mechanical forces can be difficult. Once set and locked, the stinger is released from the packer body and the internal seals are free to move in the sealbore, protected from damage or debris. When reservoir testing is

complete, a straight pull releases the slips, retracts the packer seal element, and opens an internal bypass valve so the string can be retrieved from the well without swabbing.

This technology has been widely tested in the Middle East, where it has delivered several benefits—including reduced rig time—through simplification of the downhole test string. The CERTIS system replaces what previously typically required six tools, and eliminates the time required to connect, deploy, and disconnect them. Less tools in hole with less connections means less possible leak-paths, which is a key benefit in environments with high concentrations of H₂S.

The new single-trip retrievable high-integrity isolation system



Emmanuel Delvaux.

“Many wells in the region, particularly gas producers, exhibit high pressures, high temperatures and very high concentrations of hydrogen sulphide ”

provides further benefits and increased flexibility. It enables reservoir testing with a retrievable test string design even in harsh reservoir conditions. In one well in the Arabian Gulf, a conventional packer assembly could not be used due to high bottomhole pressures and temperatures coupled with high H₂S content.

A solution using the new CERTIS isolation system was prepared and mobilized for the job within 48 hours, successfully testing the well while flowing gas, benefiting from increased safety and reliability, and reducing rig time by an estimated four hours by eliminating the need for slip joints and drill collars in the string.

Most wells in the Middle East are onshore or in shallow water, where rig-time cost is not as critical as in deep water. However, safety remains a key issue where the new system can provide improvements; especially in potentially hazardous environments such as those associated with high H₂S concentrations.

ACCURATE MEASURE

The CQG crystal quartz gauge uses a single quartz crystal to measure both pressure and temperature at the same point with high-accuracy and high-resolution. Enabled by the dual-mode pressure sensor and an accurate clock, real-time dynamic compensation ensures measurement stability with minimal drift. As a result, long-term pressure transients can be acquired for deep reservoir investigation.

REPRESENTATIVE FLUID SAMPLES

SCAR inline independent reservoir fluid sampling captures multiple independent fluid samples

“The CQG crystal quartz gauge uses a single quartz crystal to measure both pressure and temperature at the same point with high-accuracy and high-resolution”



Christophe Rojasof Schlumberger Testing Services collected the Oil & Gas Middle East Award for Best Technology Implementation in 2010.

and maintains them at reservoir conditions with independent nitrogen gas charges. Capable of acquiring up to six 600 cc samples or up to ten 300 cc samples per trip directly from the flow stream to minimize contamination, the samplers can be activated simultaneously or selectively at any time during the flow sequence using annulus pressure.

This system has been used throughout the Middle East to provide high-quality single-phase samples in both open- and cased-hole applications. The system eliminates the possibility of contaminants caused by dead volumes and ensures that samples remain in a virgin state for analysis.

FLEXIBLE VALVE CONTROL BETTER DECISIONS

The IRDV intelligent remote dual valve, which includes a tester valve and a circulating valve, maintains control during testing operations. The tester valve controls flow from the reservoir to the surface, and the circulating valve controls flow between the annulus and the test string. This field-proven tool is operated by low-pressure pulses sent down the annulus, allowing it to operate independently of any other tools or guns in the string. Valves are hydraulically powered by and referenced to hydrostatic pressure, and are immune to temperature and pressure fluctuations. For optimal downhole testing operations, the tester valve and circulating valve can be operated

simultaneously, independently, or sequenced to operate automatically.

The IRDV tool has been used in several gas wells in the Middle East region. Testing gas wells usually requires more cycles than for oil wells, particularly when producing from several zones. In the case of high H₂S levels, wells must be shut-down during testing operations in certain weather conditions. The tool has capacity for 24 cycles—12 openings and 12 closures. In some instances, two IRDV tools have been run in series, further increasing flexibility. This configuration leverages the pulse activation functionality that can put one of the tools into “sleeping” mode, enabling the second tool to be operated independently. This provides the potential to double the number of available testing cycles, and also provide a backup in case of equipment failure in harsh reservoir environments, sometimes made even more hostile through acid stimulation treatments.

Real-time remote supervision and collaboration is available for testing services using the InterACT system. Expert assistance is provided from OSC* Operation Support Centers located in strategic locations around the world and in some client offices. Customers can share data and decisions from any location through a secure web-based data delivery system.

The deep-reading, high-resolution pressure measurements and representative reservoir fluid samples provided by the new technology will help operators in the region more accurately prove their reservoir potential and reach a better basis for their decisions. **Oil&Gas**