

Dennis Denney, JPT Senior Technology Editor

Electromagnetic Tomography—Schlumberger’s DeepLook-EM enhanced crosswell-monitoring system includes prelogging planning, modeling, simulation, acquisition, processing, and inversion, all encompassed in a logical workflow culminating in a comprehensive interpretation of interwell resistivity profiles. Where traditional wireline logs tell what is in the wells, these logs show what is between them. The system offers much higher resolution than seismic methods for sweep-efficiency monitoring, bypassed-pay detection, and reservoir-simulation optimization, and it can generate detailed images between wells up to 3,280 ft apart (**Fig. 1**). Based on induction-logging principles, the acquisition uses a dynamic transmitter sonde to log one well while an array of receivers is positioned in an offset well. Wells can be openhole or cased; the interference of the steel casing is overcome by lowering the tool’s excitation frequency. Field tests provide vital information on the efficacy of water- and steamflood programs allowing identification of flow mechanisms and imaging of potentially bypassed pay zones. Interwell heterogeneities

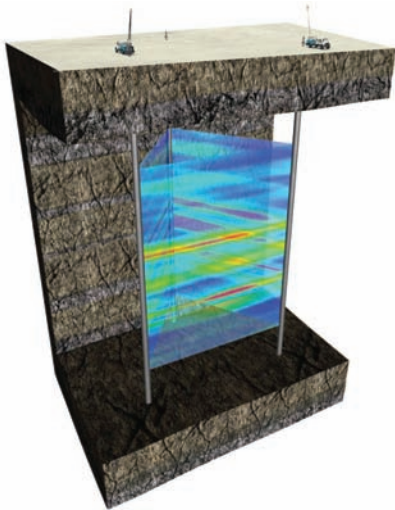


Fig. 1—Schlumberger’s DeepLook-EM tomography logging fills in the gaps between wells to profile reservoir-fluid movement, locate bypassed hydrocarbons, and quantify injection sweep efficiency.

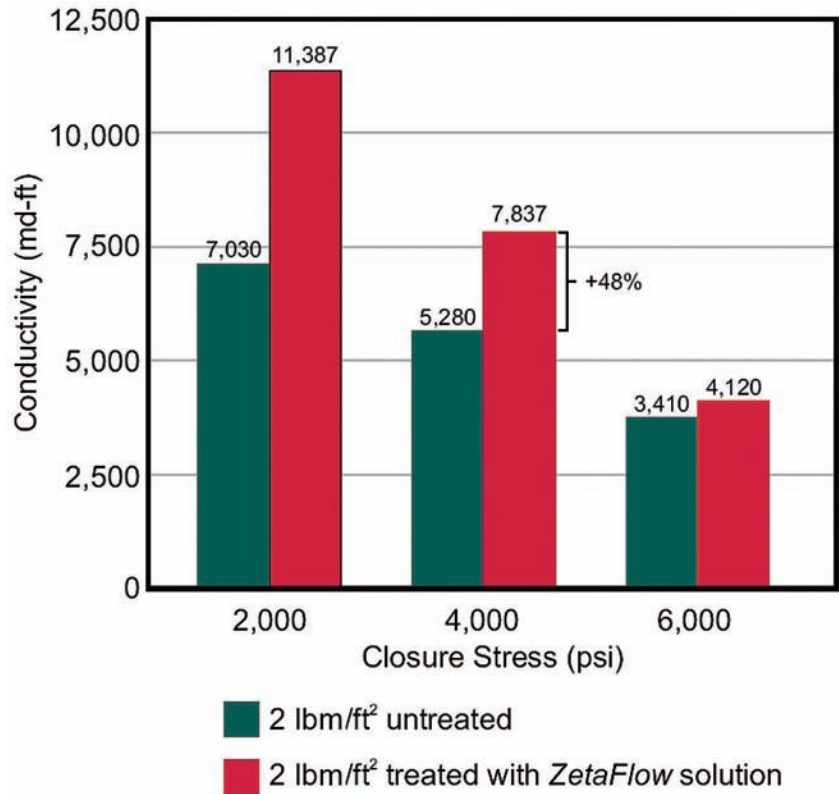


Fig. 2—Conductivity comparison: 20/40-mesh lightweight ceramic proppant with and without Weatherford’s ZetaFlow treatment.

that affect reservoir drainage and overall fluid movement, which are invisible to seismic, can be detected and their effects analyzed. Interwell resistivity variations can be caused by subsidence (porosity reduction), changes in saturation (waterflooding), and temperature (steamflooding). By monitoring fluid movements on a reservoir scale, this system provides an understanding of and predicts reservoir dynamics more precisely than in the past. All field data are compiled within the company’s Petrel seismic-to-simulation software, and are integrated seamlessly into the model to interpret the logged reservoir volume. Parameters are constrained within the limits of geologic sense, and the acquisition model is cross-checked against simulation results to ensure that the scenario is appropriate for the measurement. This checking provides advance assurance that the measure-

ment is capable of delivering expected results under the given conditions.

For additional information, visit www.slb.com/deeplook.

Conductivity Enhancer—Weatherford’s ZetaFlow system is a patented chemical solution that enhances conductivity and provides fines control in a variety of stimulation fluids and applications (**Fig. 2**). This product also enhances load recovery during flowback operations. This system can be used on a variety of sandstones, carbonates, coals, and shales. It works by changing the zeta potential of solid surfaces to create enhanced conductivity in the proppant pack and control fines migration. The zeta potential indicates the degree of repulsion between adjacent, similarly charged particles in a dispersion. During propped-fracture treatments, the solution treats the prop-

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Fig. 3—Halliburton’s 7-in. ultra-high-pressure perforating gun.



Fig. 4—TAM TripSAVR for testing blowout preventer and riser connections.



Fig. 5—Hughes Christensen’s GaugePro XPR expandable reamer, left, and GaugePro XPS expandable stabilizer, right.

ment surface to provide a strengthened charge between the particles to align the proppant pack. Fines control is achieved in the same manner. When formation particles are treated with the solution, the zeta potential of the fines is altered to promote an environment of agglomeration. The potentially production-damaging particles are fixed in place without restricting production flow. The chemistry of the package leaves the formation less hydrophilic and in the optimal wetted condition, which helps to increase load recovery and gas production.

For additional information, visit www.weatherford.com/engineeredchemistry.

30,000-psi Perforating Gun—Halliburton introduced its perforating technology for high-pressure wells. The 7-in.-outside-diameter perforating gun can perform at pressures of up to 30,000 psi, specifically in deepwater environments. The High-Pressure Gun System (**Fig. 3**) can be conveyed on tubing, wireline, or slickline in 9⁵/₈ and 10¹/₈ in. casing. The system uses 60 or 120° phasing with a 15-shot/ft shot density. This ultrahigh-pressure gun uses bidirectional boosters, nonlead azide explosives, specialized connectors and inserts, and high-velocity/low-shrink detonating cord to help meet proprietary specifications for safety and reliability assurances. The 30,000-psi fully programmable electronic firing head is capable of low-pressure-cycle operation and allows for immediate or delayed

detonation. As more-challenging and -complex wells are explored, flexibility is needed for downhole pressure-operated tools. The firing head can initiate the gun system through a predetermined sequence of events. Programming flexibility can provide delay times of minutes, hours, or days, and can be set to work under virtually any completion sequence. The firing head can be used as a primary or secondary firing head for any tubing-conveyed perforating operation. A special pressure transducer senses a sequence of pressure cycles to activate the firing head. This method effectively lowers the pressure-activation window. Once a series of programmable conditions are met (a unique user-defined number of cycles of different durations at different intervals at different pressures), the gun will fire instantly or after a preprogrammed delay.

For additional information, visit www.halliburton.com/wireline.

Riser Testing at Surface—TAM International introduced its TripSAVR external-inflate packer (**Fig. 4**) that enables pressure-testing of the various internal seals and connections of a lower-marine-riser package (LMRP) offline at the surface. The packer uses an exposed-slat inflation element mounted on an externally inflated packer assembly, and the tool can be inverted, allowing multiple pressure tests from above or below the desired area. The exposed slats act as an anchor to hold the packer in place. Testing with this packer identifies pressure leaks at the

surface, before a lengthy trip to the seafloor in deep water. The flush bottom serves as a locator, enabling correct space-out and testing of any LMRP. A specially designed pump-in subassembly allows the use of any hydraulic pump for inflation and pressure testing, freeing up the rig pump for other operations. The external-inflate packer has a 14¹/₂-in.-outside-diameter element with an effective working range of 16 to 30 in. diameter.

For additional information, email bob.brooks@tamintl.com.

Expandable Reamer—Hughes Christensen’s GaugePro XPR expandable reamer (**Fig. 5**) can eliminate reamer problems including complexity, activation, downhole failures, and vibration/stability dysfunction. This concentric hole-enlargement technology remains closed until triggered, opens on command, reams an in-gauge hole, and then closes to come out of the hole properly. The pilot-bit design is synchronized to the expandable reamer in a fit-for-purpose drilling assembly and provides an enhanced downhole operating environment. A drop-ball method triggers the expandable reamer. The cutter blades are activated by fluid circulation and deactivated when circulation is stopped, which eliminates premature triggering independent of weight on bit (WOB), flow, or bottomhole-assembly pressure. Vibration is reduced significantly when the pilot bit is restrained with the company’s EZSteer depth-of-cut control technol-



Fig. 6—Universal Well Site Solutions’ UniSkid wellsite manager.

ogy without reducing the rate of penetration (ROP). The company’s XPS expandable stabilizer can be used above the reamer to increase drilling efficiency by eliminating collar whirl for higher ROP with lower WOB. Operators can drill and ream simultaneously, or can enlarge a previously drilled pilot hole. The blade motion—angled radially outward and upward—is a fail-safe measure to ensure cutter-blade retraction. The company’s Genesis polycrystalline-diamond-compact cutters address challenging drilling applications. The one-piece body is constructed from a high-tensile-strength fatigue-resistant material. Proprietary hard-faced interchangeable wear pads eliminate heat-affected zones and crack propagation. Strategically placed interchangeable nozzles for each cutter blade improve cuttings removal and transport.

For additional information, visit www.bakerhughes.com/gaugepro.

Wellsite Management—Universal Well Site Solutions announced completion of comprehensive field testing and market availability of its UniSkid wellsite manager (**Fig. 6**). The system was designed to replace old processes and provide fast coalbed-methane wellsite hookup, with all equipment communicating immediately. The system is a gasfield plug-and-play technology. It

provides real-time information to aid increasing production. The platform allows operators to determine what kind of additional wellsite equipment should be included in their design. Separators, gas-flow measurement, water-flow measurement, downhole-pressure measurement, and communication devices are primary components. The variable-frequency drive can control pump motors of 0.5 to 150 hp. The gas-flow meter measures rates of 5 to 890 Mcf/D. The water-flow meter measures rates of 2.6 to 350 gal/min. Systems are fitted with an operator interface that can be programmed manually. Communication antennas are an option that enables information transfer from the wellsite to the operator’s computer anywhere in the world.

For additional information, visit www.universalwellsite.com.

Third-Generation Multiphase Meter—Roxar ASA launched its third-generation MPFM 2600 multiphase meter (**Fig. 7**) based on its Zector Technology. The meter’s new field electronics, electrode arrangements, and voxel-based signal processing provide higher accuracy than was available previously. The new technology allows 12,000 measurements per second for simultaneous flow-sector investigation. The technology enables an accurate



Fig. 7—Roxar’s MPFM 2600 multiphase meter.

understanding of flow regimes, mixing effects, and velocity profiles. It can detect rapid changes in composition, making measurements more accurate and consistent than previously possible. The new technology measures multiple oil- and gas-flow velocities as a function of its location. For example, near-wall velocity will be different from center-of-the-pipe velocity. Velocities change over time because of changes in composition and turbulence, viscosity, and other effects, and are recorded, providing 4D information. The 3-in. model weighs 110 kg and is 650 mm long. The meter can be installed on individual wells in previously inaccessible locations. The standard version does not use radioactive technology and covers an operating range of 0 to 100% water cut and 0 to 100% gas-void fraction (GVF). For special applications or GVF above 95%, it is recommended to add a compact gamma-density system to the meter. The new electrode-sensor geometry enables measurements in separate sectors in addition to the full cross-sectional area. The field-electronics system allows capacitance and conductance measurements to be combined. Rather than switching between oil and water continuous mode in a matter of seconds, operators can switch modes in milliseconds. **JPT**

For additional information, email zector@roxar.com.