Delivering deepwater excellence
Delivering deepwater excellence

Wireline services to enable reservoir value

bhge.com
The 3D eXplorer™ (3DeX™) from Baker Hughes, a GE company (BHGE), was the first multicomponent induction device introduced to the industry. It remains the benchmark for the quantitative evaluation of thinly laminated clastic intervals in nonconductive environments and additionally delivers comprehensive structural dip from the nine component sensors.

**CAPABILITIES**
- Fully combinable with all petrophysical, imaging and formation testing services
- Industry-leading laminated sand shale analysis
- Accurate and automated structural dip and azimuth in challenging boreholes (e.g. rugose and OBM systems)
- Available in HPHT (350°F and 30K PSI)
- Hole sizes from 4.5 in. to 20 in.
- No mud weight limitations

**TECHNOLOGY**
- Nine coil arrays at 14 frequencies
- Two-ft vertical resolution for Rh and Rv
- Hole deviation from 0 to 90°
- Works in both mud systems (i.e. WBM or OBM)
- Patented multifrequency processing that eliminates effects of the near borehole zone (e.g. invasion)
- Measures all nine magnetic field components at multiple frequencies (20-220 kHz)

**EXPERIENCE**
- >400 jobs 2013-2016
- 100% service efficiency in deepwater (last 5 years)
- First multicomponent induction service delivered for GoM DW HP wells (>25,000 psi)
- Successful deployments at depths over 34,000 ft
- Service combinations have included GeoXplorer™ imaging, XMAC™ acoustics, FTeX™ formation testing, MReX™ NMR and all standard petrophysical logs
The FLeX™ Formation Lithology eXplorer™ service was the first induced gamma ray spectroscopy instrument to feature a pulsed neutron source. The wide spectrum data produced by the FLeX service, together with the RockView™ analysis, provides the most robust quantitative mineralogical interpretation available.

FLeX™ and RockView™

The FLeX™ Formation Testing eXplorer™ is the most advanced formation pressure testing service in the industry. Designed for the utmost speed, accuracy, and flexibility, the service features state-of-the-art downhole automation and a level of combinability that is unrivalled.

FTeX™

CAPABILITIES
- Fully combinable service
- Green service—no chemical sources
- Comprehensive mineralogy using elastic and inelastic spectra
- Direct measurement of C, Al, Mg, O
- Determine total organic content (TOC)
- Identify heavy oil and bitumen
- Full mineralogy available in cased hole

TECHNOLOGY
- Mineralogy is determined from the measured elemental weights present in the formation. The service takes the natural gamma ray energies to determine the thorium (Th), potassium (K), and uranium (U) fractions and the non-radioactive elements from the gamma ray spectra induced by the neutron collisions
- 14.2 MeV neutrons are produced using an electronic pulsed neutron source generator
- Gamma rays are detected by bismuth germanium oxide (BGO) detectors
- The FLeX tool is packaged inside a high-strength titanium housing for enhanced environmental capabilities

EXPERIENCE
- >1,000 runs globally 2013–2016
- GoM experience with high-pressure characterization and deployment of service
- Downhole automated testing mode
- Fast, accurate, consistent data
- Each test analyzed downhole at a rate of 100x/sec
- Subsequent tests learn from the formation response and parameters are optimized
- Custom testing sequences available
- Mobility ranges as low as 0.001 mD successfully tested
- Range of packer geometries available
- Combinable with all openhole services
- Qualiﬁed for use in hostile environments (30K PSI)
- All-titanium construction for maximum robustness

CAPABILITIES
- Reliable and accurate pressure data by combining downhole automation with real-time control
- Intelligent platform allows FTeX to reduce the possibility of human error and minimize test time by optimizing the operation sequence
- All-electric drawdown pump for maximum control, automation, and accurate ﬂowrate
- Test parameters and controls for drawdowns are set automatically
- Tool OD: 3½ in.

TECHNOLOGY
- >70 jobs in last year with more than 97% operational efficiency
- Outstanding GoM service history
- Zero NPT since introduction
- Wells over 30,000 ft and 23,000 psi
- Successful high-temperature (>360°F) deployments
- GoM rig time savings >24 hours in single deployment
- Popular addition to GoM first wireline descents in exploration/appraisal wells (critical data early and fast)

EXPERIENCE
- Outstanding GoM service history
- Zero NPT since introduction
- Wells over 30,000 ft and 23,000 psi
- Successful high-temperature (>360°F) deployments
- GoM rig time savings >24 hours in single deployment
- Popular addition to GoM first wireline descents in exploration/appraisal wells (critical data early and fast)
The GeoXplorer™ imaging service is the second generation high-resolution formation imager for use in nonconductive muds. The GXPL™ has a wide borehole coverage and the sensors feature multifrequency acquisition with an operating envelope tuned for low resistivity/low contrast clastic sequence evaluation.

**CAPABILITIES**
- Fully combinable with other petrophysical, FT, and NMR services
- Maximum hole size of 21 in.
- 80% borehole coverage in 8-in. holes with a single tool
- Dual GeoXplorers provide increased coverage in washed out hole sections, providing additional borehole features for reduced uncertainty
- Measurements conducted at multiple frequencies for increased operating range (i.e. formation resistivities)
- Six independent arms ensure borehole wall contact even in rugose boreholes

**TECHNOLOGY**
- High-quality images in very low resistivity formations
- Provides improved data quality in deviated wells with unique powered standoff
- Dual GeoXplorers provide increased coverage in washed out hole sections, providing additional borehole features for reduced uncertainty
- Measurements conducted at multiple frequencies for increased operating range (i.e. formation resistivities)
- Six independent arms ensure borehole wall contact even in rugose boreholes
- Unique powered stand-off reduces pad force and minimizes tool sticking

**EXPERIENCE**
- Flawless execution in GoM wells over 31,000 ft and 23,000 psi
- Successful high-temperature (>340°F) deployments
- Successfully acquired images in high-pressure environments
- Imaging service of choice for imaging in several GoM plays
- Acquisition in heavy mud weights (e.g. 18 ppg) and highly deviated wells

**CAPABILITIES**
- Evaluate the widest range of cement weights in the industry:
  - Lightweight or foam cements as low as 7 ppg
  - Contaminated or green cement
  - Deepwater wells with modified cement
  - Can evaluate non-cement solids behind casing
  - Measures in any wellbore fluid environment
  - DBM, WBM, Gas cut mud
  - Even air or gas filled wells
  - Detects the presence of a microannulus
  - No need to pressure up on casing

**TECHNOLOGY**
- Patented electromagnetic-acoustic sensors
- Direct excitation of lamb and shear waves
- Direct measurement of micro-annulus and cement integrity beyond
  - Using lamb wave analysis
  - Pad-mounted sensors
  - Works in any wellbore fluid—even gas

**EXPERIENCE**
- Industry newest cement and integrity evaluation service
- >200 jobs since 2016 launch of service
- Introduced into deepwater GoM Q4 2016
- 100% operating efficiency
- Opportunity in deepwater to evaluate green cement and save rig time

The Integrity eXplorer™ service is the only cement and zonal isolation wireline evaluation instrument to feature patented electromagnetic acoustic sensors. The unrivalled dynamic range of these sensors enables evaluation of the lightest cements, including green cement and noncement solids present behind casing.
The **BHGE Mechanical Pipe Cutter (MPC™)** is the industry-leading service for the precision cutting of downhole tubulars up to 7-in. OD. The service uniquely features a spinning blade controlled by intelligent downhole firmware to control cutting progress. The service can cut pipe in compression and an adaptation of the MPC allows for precise cutting of slots in tubulars.

### **MPC™**

- Nonballistic cutting
- Combinable with GR for precision depth control
- Cuts pipe from 2 7/8 in. OD to 7 in. OD
- Suitable for cutting production tubing, casing, drill pipe, drill collars, packer mandrels, and more
- Able to cut exotic alloys—Inconel, chrome pipe, etc.
- Able to cut beyond pipe OD to cut control lines
- Track record of cuts in compression
- Variant service can cut multiple precise slots (1–3 mm aperture height) to facilitate circulation, chemical treatment, etc.

### **TECHNOLOGY**

- Rotating blade that rotates around tool axis
- Computer-controlled cutting actuation
- Accurate measurement of pipe ID and cut depth
- Downhole automated motor control to ensure reliable cutting within tool operating limits
- Metallurgically controlled blade weakpoint
- Remote viewing/control of cutting available
- Compatible with Atlas Anywhere portable surface system
- Compatible with all competitor wirelines in the market
- Delivers machine shop quality cut

### **EXPERIENCE**

- >1,000 cuts 2013–2017
- Successful high-temperature (>380°F) deployments
- Capable of 30,000 psi operations
- Deepwater GoM compression cuts (up to 60,000 lb)
- Custom deepwater positioning adaptations for millimeter positioning accuracy
- Zero NPT in deepwater GoM operations 2016/2017
- Over 40 GoM cuts performed 2016/2017
- Typical cutting time <30 mins
- Preferred service for all cut-to-release packers in GoM

### **MReX™**

The **MReX™ Magnetic Resonance eXplorer™ service** was the first side-looking gradient field NMR instrument introduced in the industry. This innovative concept has become the industry benchmark for comprehensive NMR measurement and the MReX service remains the leading choice for capability and answer product.

### **CAPABILITIES**

- Faster logging speeds from multi-frequency acquisition and high-gradient magnetic field
- Comprehensive FE, fluid typing, and textural measurements
- Continuous T1 and T2 spectra recorded without stationary measurements
- Highest proven pressure and temperature capability comprehensive NMR service (GoM wells >340°F)
- Full combinability with all DW services
- >1,000 cuts 2013–2017
- Successful high-temperature (>380°F) deployments
- Capable of 30,000 psi operations
- Deepwater GoM compression cuts (up to 60,000 lb)
- Custom deepwater positioning adaptations for millimeter positioning accuracy
- Zero NPT in deepwater GoM operations 2016/2017
- Over 40 GoM cuts performed 2016/2017
- Typical cutting time <30 mins
- Preferred service for all cut-to-release packers in GoM

### **TECHNOLOGY**

- Side-looking antenna and a high-gradient magnetic field for comprehensive FE and fluids analysis
- 12 frequency choices for experiment and operational optimization
- Active wellbore signal cancellation
- Multiple simultaneous NMR experiments
- 0.3 ms TE echo spacing for optimum characterization of fast decay signal
- 2D NMR imaging data acquired as part of the regular logging pass without requirements for station-stop measurements
- Environmental upgrades for reliable 350°F operation

### **EXPERIENCE**

- 2,000 runs globally 2013–2016
- GoM experience in all major plays
- Only NMR service successfully operated in GoM HT wells
- GoM experience with complex combinations including formation testing, mineralogy, openhole services and imaging
- Specific deployment configurations for highest quality data and lowest risk
- Unique GoM applications include tar identification in hostile reservoirs
The **RCX™ Sentinel** is the most comprehensive testing and focused sampling platform in the industry. It has unmatched capabilities for sample recovery, with a proven track record of deployments in deepwater and hostile HP/HT environments.

### CAPABILITIES
- 840 cc and 4,000 cc inline PVT DOT sample bottles
- 700 cc inline DOT single-phase sample bottles
- 10 L and 20 L large volume sample bottles
- All samples available with full focused sampling
- Up to 52 sample bottles in a single run
- Multiple focused and standard probes in one run
- Cutting-edge fluid analysis including OD spectrometer and unique fluid properties sensors
- High LCM tolerance
- HP/HT capable

### TECHNOLOGY
- Flexible modular design
- All-titanium construction for reliability
- H₂S inert for sample integrity
- Selection of focused packer geometries for maximum efficiency
- Up to 10,000 psi overbalanced sampling capability
- Ability to sample in up-hole or down-hole configurations
- Uniquely designed for compatibility with deployment flywheel technology
- Highly combinable with other petrophysical services
- Focused sampling in up or down direction for maximum efficiency
- Utilizes IFX™ down hole fluid analyzer featuring optical density and ultra violet spectrometers, together with refractive index, fluid density, viscosity and GOR measurements

### EXPERIENCE
- >30 deepwater jobs in GoM in last two years
- >97% samples recovered @ <1% contamination
- >95% sealing efficiency
- Successful sample collection at >35,000 ft
- >15 successful deepwater GoM deployments with dual probe RCX Sentinel for optimum configuration
- Successful deepwater deployment of large area focused packer for unconsolidated reservoir
- Successful combination runs with advanced petrophysical services for maximum efficiency (e.g. FLex™ Formation Lithology eXplorer™ service)