Schlumberger Conveyance Portfolio

- Offering a wide range of conveyance systems and solutions to meet customer well intervention situations and needs
  - Slickline, Wireline, Tractors, Coiled Tubing, Drill pipe
Slickline Focus

- Schlumberger and Geoservices legacy slickline businesses combined
  - Sizable slickline entity: local workforce; global coverage
    - 11 Regions
    - 700 Units
    - 2300 Employees
  - Dedicated and active investment in slickline: infrastructure; people; processes; technology
    - Digital slickline, Optic line, Winch & Units, Downhole tool suite, ...
    - Slickline specific Pressure Operating Manual and Explosive Standard
    - Training and Development for operations workforce
Slickline Services Delivery Entities
Slickline Intervention and Diagnostics

Benefits
- small footprint, mechanical integrity, logistical simplicity, operational efficiency, cost effectiveness

Limitations
- clarity of toolstring status
- depth precision
- downhole tool capability
- over dependence on slickline operator’s experience level

... maintain the benefits, overcome the limitations
Introducing LIVE Digital Slickline Services

Telemetry enabled real time slickline
- correlation **precision**
- **confirmation** of tool status
- continuous **control**

Providing
- minimized logistics
- reduced time and trips
- increased access of advanced diagnostics
- reduction in deferred production

... delivering time, cost and risks minimization
LIVE Digital Slickline Innovation

Digital data telemetry
- real time two way communication
- standard slickline compatible

Surface readout of critical data
- toolstring shock, deviation, movement, head tension
- natural gamma ray and CCL
- borehole pressure & temperature
- surface controlled jarring and tool release

Purpose built family of tools for Set, Seal, Perf, PL

... all on Slickline conveyance
LIVE Digital Slickline family of services

**LIVE Act**  mechanical services, with accurate depth and tool status monitoring

**LIVE Set**  explosive free, hydraulically set plug and retainer services

**LIVE Seal**  non elastomeric sealing, for standard or monobore completions

**LIVE Perf**  perforate, punch and pipe recovery services with depth precision

**LIVE PL**  comprehensive production logging with real time measurement and control
LIVE Digital Slickline Services — the Platform

**Digital Slickline Cable**
- Sandvik 0.108" 5R60 stainless steel alloy (0.138" OD after coating)

**Digital Slickline Core Tools**
- Cable head
- Basic Measurement Cartridge: shock / tension / deviation / movement
- Depth Correlation Cartridge (GR/CCL)

**Digital Slickline Surface Equipment**
- Standard winch / drum / pulleys / stuffing box
- Surface Transceiver and PC
Digital Slickline Technologies – Cable

Cable core
- Sandvik 5R60 Stainless Steel
- 0.108” and 0.125” available

Insulation Specification
- Proprietary polymer compound
- Non reactive, H2S resistant

Sour Service Cable
- Engineering on Sanicro 36Mo to start Q4’11
Digital Slickline Technologies – Digital Jar

D-Jar Downhole adjustable jar
- repeated jarring
- surface controlled, cable energized
- in situ real-time adjustment
- downhole tension and shock measurement
- reduced undue stress
Digital Slickline Technologies – Digital Jar

Loading the D-Jar:
300 lbs line tension

Firing the D-Jar:
command sent from surface
Digital Slickline Technologies – Digital Jar

Loading the D-Jar:
500 lbs line tension

Firing the D-Jar:
command sent from surface
Digital Slickline Technologies – Digital Jar

Increasing Jar Force

Downhole head tension, jarring force and shock (acceleration) viewed and recorded at surface in real time.

Increasing tension
Digital Slickline Technologies – Controlled Release

DCR digital controlled release tool
- controlled, on demand toolstring separation
- full cable removal
- internal and external fishing profile remains
Digital Slickline Operations

> 450 operations performed during field test
  - Well depth: maximum 16,000ft,
  - Well deviation: maximum 59 degree
  - Pressure: maximum WHP 3500 psi; maximum BHP 8000 psi
  - Temperature: minimum surface temp -10°; maximum BHT 275 °F

Ongoing activity
  - US, France, Indonesia

New deployment
  - Alaska, Saudi, Algeria, Brazil, UK
DSL Case Study 1 – Integrated operations

Requirement – Well Prep and Production Logging
- slickline: gauge cutter, plug installation, SSSV lockout
- eLine: static gradient, drawdown/shut-in pressure/temperature survey per zone

Application – Digital Slickline used for entire operation
- single unit / crew mobilization
- single rig up / down operation
- pressure control equipment rationalization

Result
- risk minimization / elimination
- reduction in operational time and deferred production
DSL Case Study 2 – Risk Reduction

Requirement – Monitor salt dissolution path in halite (rock salt) deposits
- gamma ray to map salt dissolution
- temperature to trace injection water
- manage risk of tool loss due to corrosion and casing collapse

Application – Digital Slickline LIVE Act service
- combined gauge cutter / spang jar functionality, plus real time gamma ray / wellbore temperature measurements
- real time head tension monitoring of tool hang up

Result
- tool stuck risk minimization
- efficiency gains through multiple surveys per day
DSL Case Study 3 – precise non-explosive setting

Requirement – Setting of bridge plug
- depth accuracy required,
- plugs set at depths ranging from 4,100 ft to 12,699 ft

Application – Digital Slickline LIVE Set service
- plugs set with D-Set electro-hydraulic setting tool
- real time SRO of GR / CCL for accurate depth correlation

Result
- precise depth setting
- plug setting QC with real time tool status monitoring
DSL Case Study 3 – precise non-explosive setting
DSL Case Study 4 – perforation operation

Requirement – establish communication in completion
- precise depth accuracy
- operation optimization with single crew

Application – Digital Slickline LIVE Perf service
- real time SRO of GR / CCL for accurate depth correlation

Result
- CCL log detected error in well sketch
- program modified in situ, no additional runs required
- incorrect operation averted
DSL Case Study 4 – perforation operation

**Basic Measurement Cartridge**
- Depth Correlation Cartridge
- Digital Pressure Gauge
- D-Trig Digital Activation Device
- 1-11/16” HSD Gun circulating charges
- Length 20ft

**Correlation:**
- Gamma Ray
- Collar locator
- Cable Velocity
- OTIS XA Sliding Sleeve
- 2 3/8” x 20 ft Blast Joint (Qty 5)

**Confirmation:**
- 20 ft Perforated Interval

**Control:**
- Reference Depth
- Shot Detection
- Downhole Tension
- Cable Velocity

**2 3/8” x 31 ft Tubing Joint**
LIVE DIGITAL SLICKLINE SERVICES

. . . providing precision, certainty and control

. . . expanding the scope, and enhancing the accuracy, quality, safety and efficiency of all slickline operations

Why compromise?