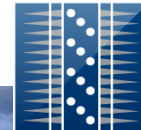


LIVE

DIGITAL SLICKLINE SERVICES



Schlumberger

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



Wireline



Tractor



Coiled Tubing



Drill Pipe



Schlumberger Confidential



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



Schlumberger Confidential



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



Schlumberger Confidential

. . . maintain the benefits, overcome the limitations



Introducing LIVE Digital Slickline Services

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



Schlumberger Confidential

. . . delivering time, cost and risks minimization



Schlumberger

LIVE Digital Slickline Innovation

LIVE

DIGITAL SLICKLINE SERVICES

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



Schlumberger Confidential

. . . all on Slickline conveyance



Schlumberger

LIVE Digital Slickline family of services

LIVE

DIGITAL SLICKLINE 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)

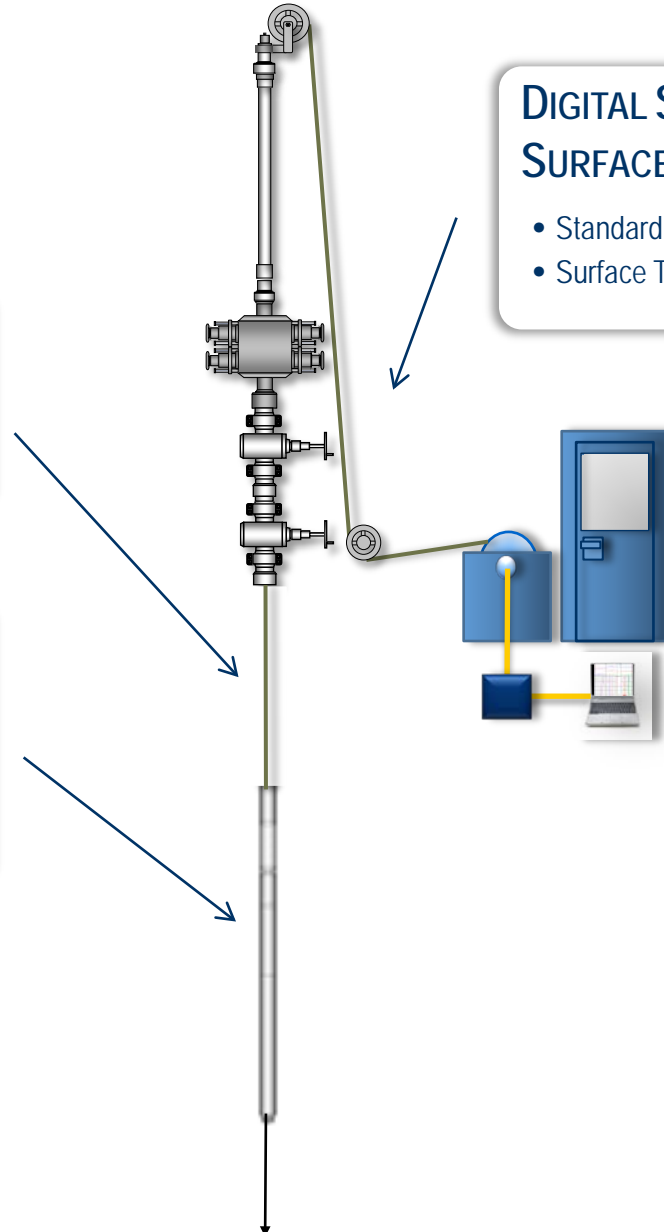


DIGITAL SLICKLINE CORE TOOLS

- 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





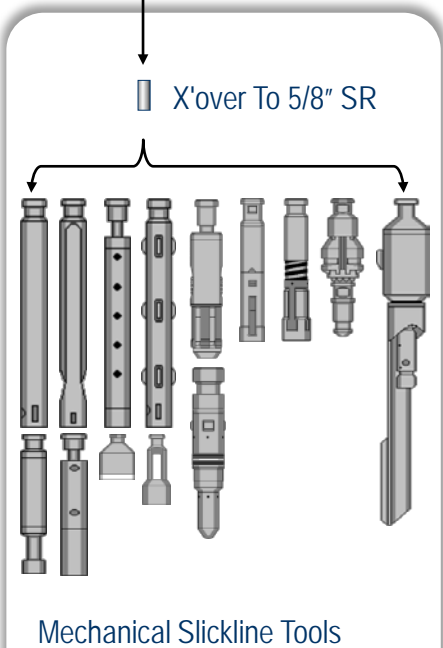
Centralizer Extended Battery Flex Joint Sinker Bar

OPTIONAL ACCESSORIES



Digital Pressure Gauge Interactive Jar Controlled Release device

OPTIONAL TOOLS



X'over To 5/8" SR

Mechanical Slickline Tools

LIVE Act



Wired Jar

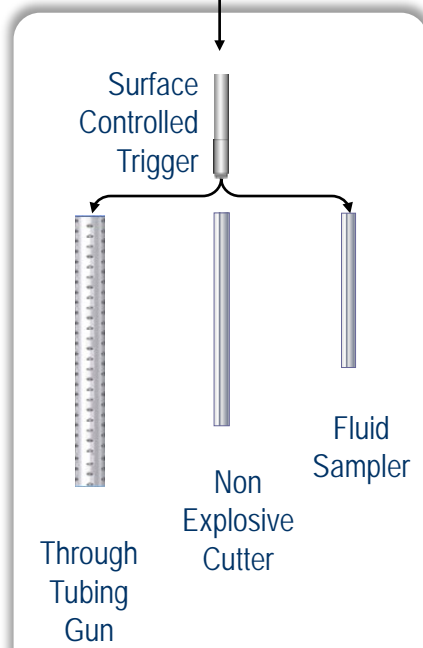
Dset1 Dset2 Dset3

LIVE Set



GeoLock

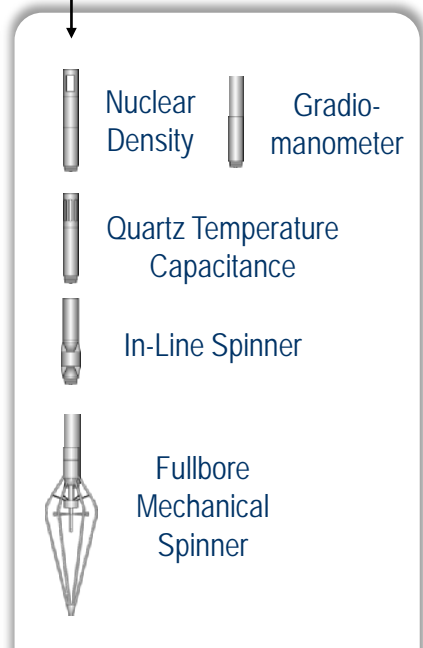
LIVE Seal



Surface Controlled Trigger

Through Tubing Gun Non Explosive Cutter Fluid Sampler

LIVE Perf



Nuclear Density Gradio-manometer

Quartz Temperature Capacitance

In-Line Spinner

Fullbore Mechanical Spinner

LIVE PL

DIGITAL SLICKLINE FAMILY OF SERVICES

Digital Slickline Technologies – Cable

LIVE

DIGITAL SLICKLINE SERVICES

Cable core

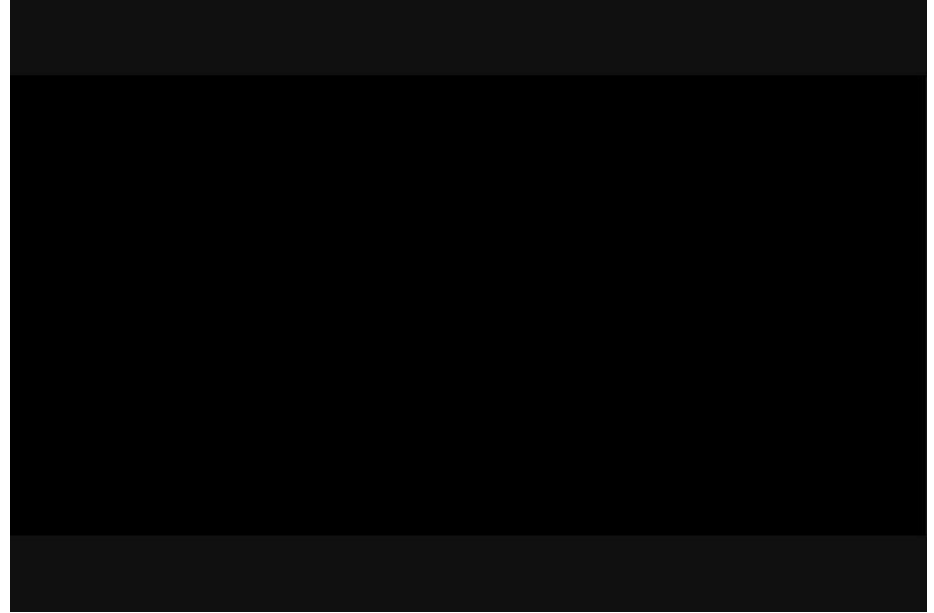
- Sandvik 5R60 Stainless Steel
- 0.108" and 0.125" available

Insulation Specification

- Proprietary polymer compound
- Non reactive, H₂S resistant

Sour Service Cable

- Engineering on Sanicro 36Mo to start Q4'11



Schlumberger Confidential



Digital Slickline Technologies – Digital Jar

LIVE

DIGITAL SLICKLINE SERVICES

D-Jar Downhole adjustable jar

- repeated jarring
- surface controlled, cable energized
- in situ real-time adjustment
- downhole tension and shock measurement
- reduced undue stress



Schlumberger Confidential



Schlumberger

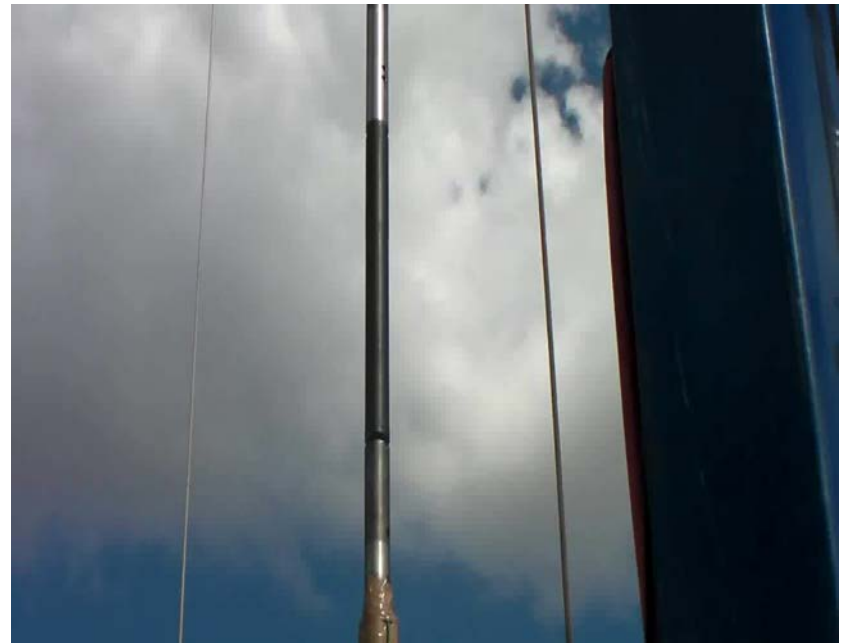
Digital Slickline Technologies – Digital Jar

LIVE

DIGITAL SLICKLINE SERVICES



Loading the D-Jar:
300 lbs line tension



Firing the D-Jar:
command sent from surface

Schlumberger Confidential



Schlumberger

Digital Slickline Technologies – Digital Jar

LIVE

DIGITAL SLICKLINE SERVICES



Loading the D-Jar:
500 lbs line tension



Firing the D-Jar:
command sent from surface

Schlumberger Confidential

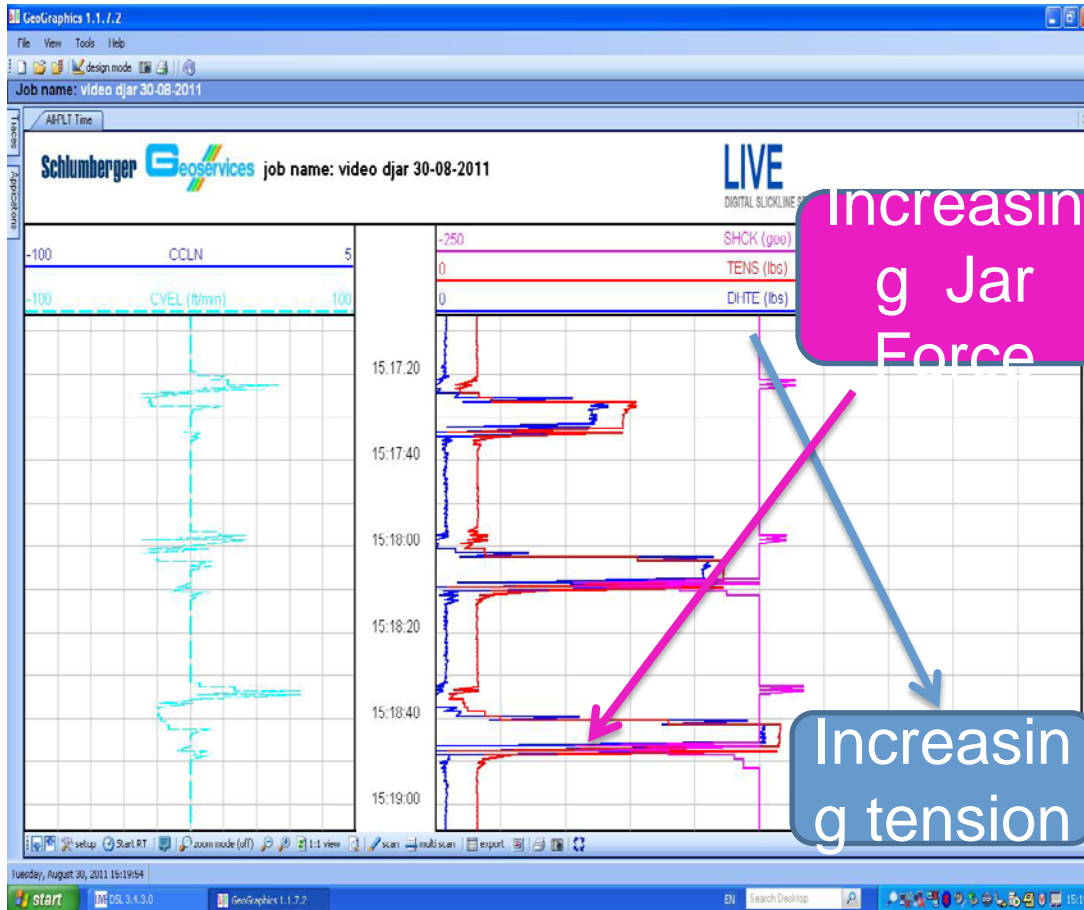


Schlumberger

Digital Slickline Technologies – Digital Jar

LIVE

DIGITAL SLICKLINE SERVICES



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

Schlumberger Confidential



Schlumberger

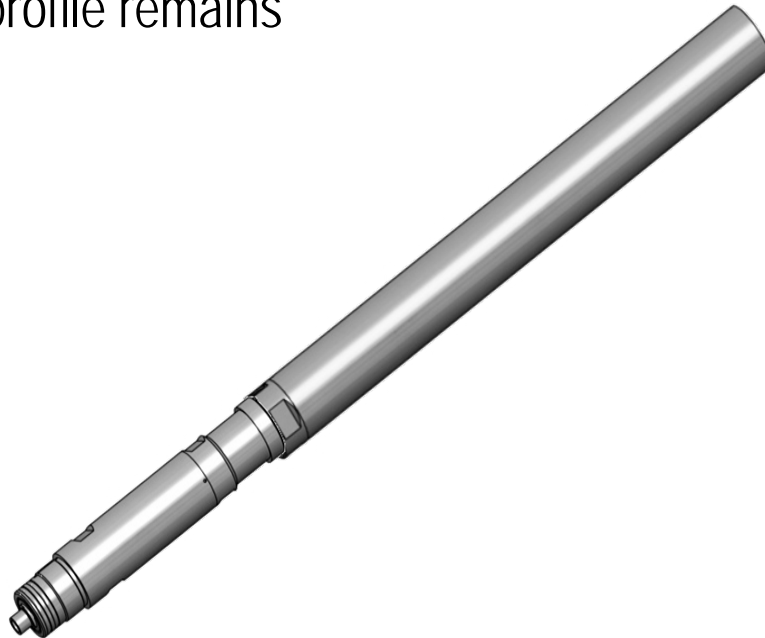
Digital Slickline Technologies – Controlled Release

LIVE

DIGITAL SLICKLINE SERVICES

DCR digital controlled release tool

- controlled, on demand toolstring separation
- full cable removal
- internal and external fishing profile remains



Schlumberger Confidential



Schlumberger

Digital Slickline Operations

LIVE

DIGITAL SLICKLINE SERVICES

> 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



Schlumberger Confidential



Schlumberger

DSL Case Study 1 – Integrated operations

LIVE

DIGITAL SLICKLINE SERVICES

Requirement – Well Prep and Production Logging

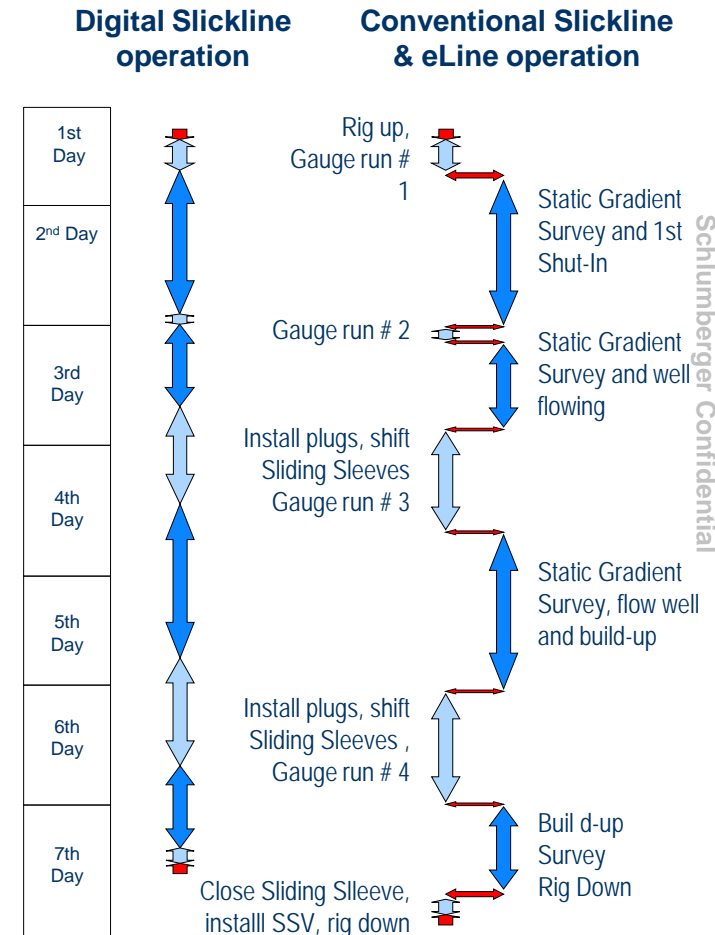
- slickline: gauge cutter, plug installation, SSSV lockout
- eLine: static gradient, drawdown/shut-in pressure/temperature survey per zone

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

LIVE

DIGITAL SLICKLINE SERVICES

Requirement – Monitor salt dissolution path in halite (rock salt) deposits

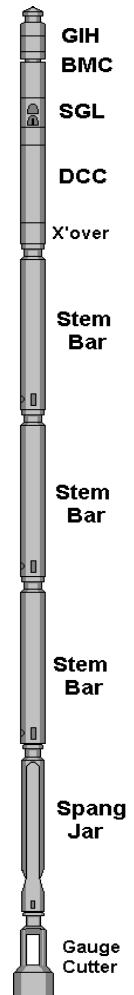
- gamma ray to map salt dissolution
- temperature to trace injection water
- manage risk of tool loss due to corrosion and casing collapse

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



Schlumberger Confidential

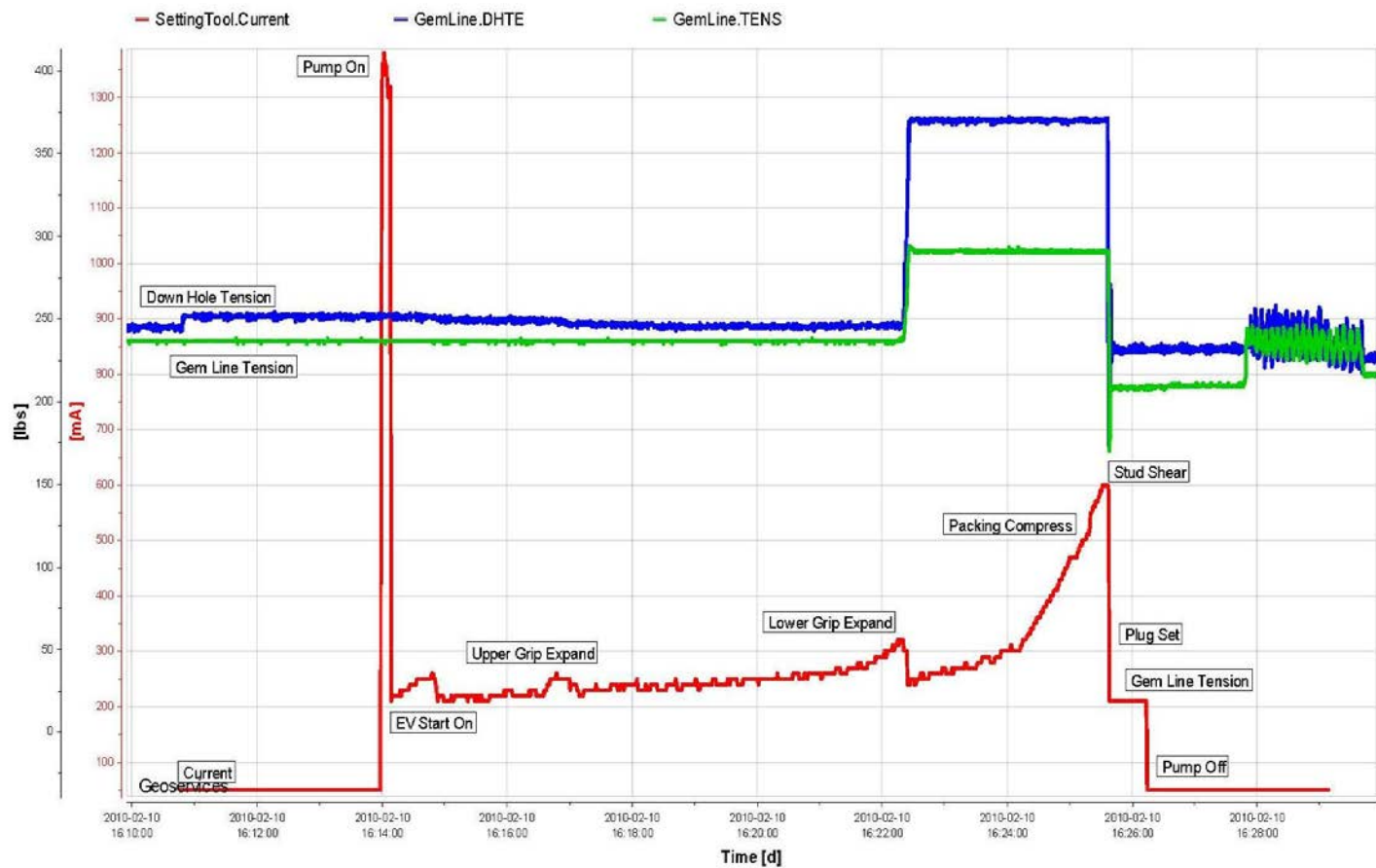


DSL Case Study 3 – precise non-explosive setting

LIVE

DIGITAL SLICKLINE SERVICES

Setting Big Boy Plug



Schlumberger Confidential



DSL Case Study 4 – perforation operation

LIVE

DIGITAL SLICKLINE SERVICES

Requirement –establish communication in completion

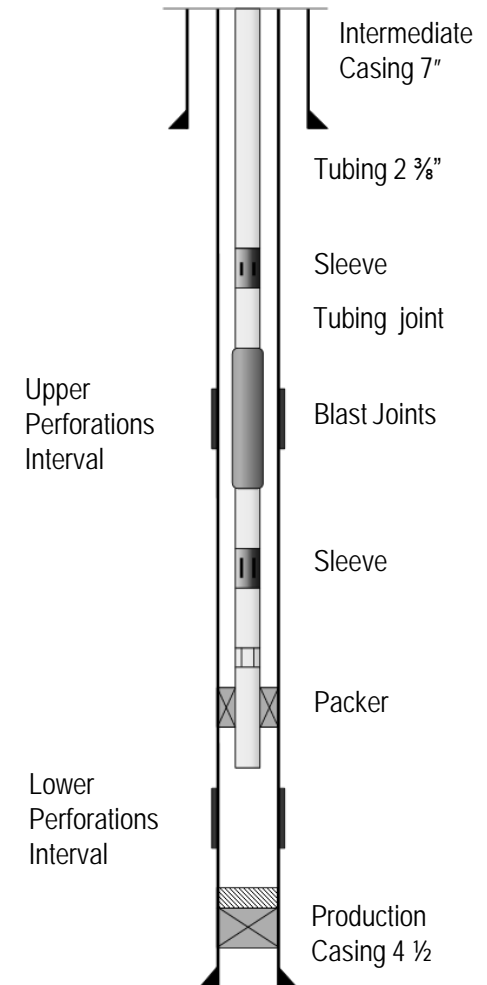
- precise depth accuracy
- operation optimization with single crew

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



Schlumberger Confidential



DSL Case Study 4 – perforation operation

LIVE

DIGITAL SLICKLINE SERVICES



Basic Measurement Cartridge

Depth Correlation Cartridge

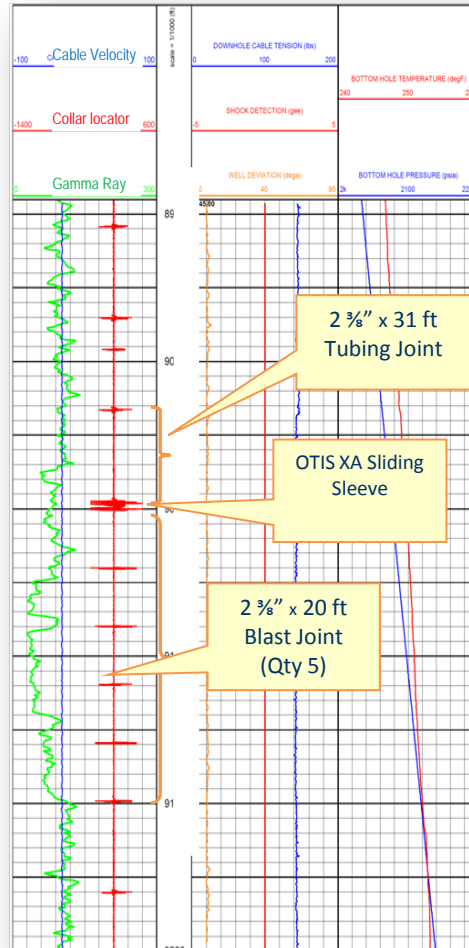
Digital Pressure Gauge

D-Trig Digital Activation Device

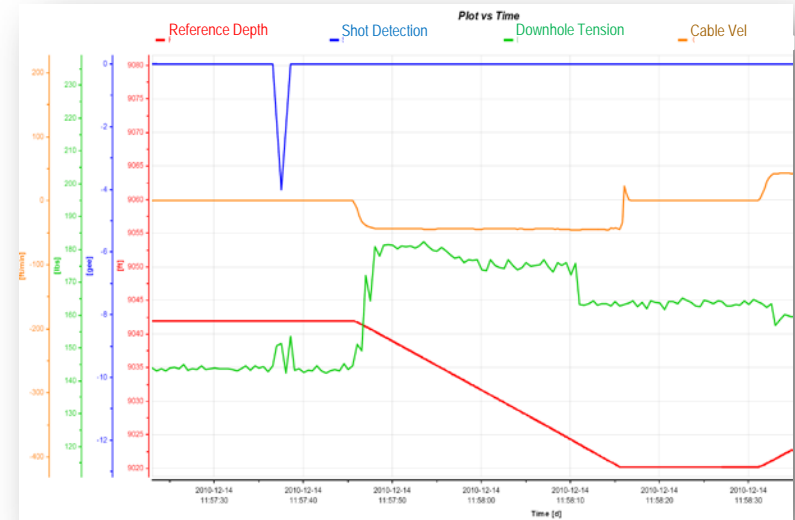
1-11/16" HSD Gun circulating charges

Length 20ft

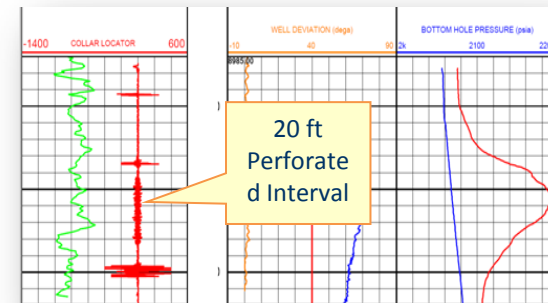
CORRELATION:



CONTROL:



CONFIRMATION:



Schlumberger Confidential



Schlumberger

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?