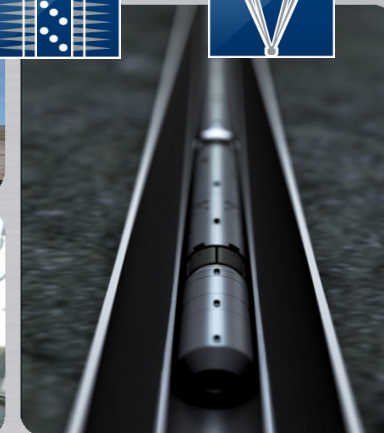
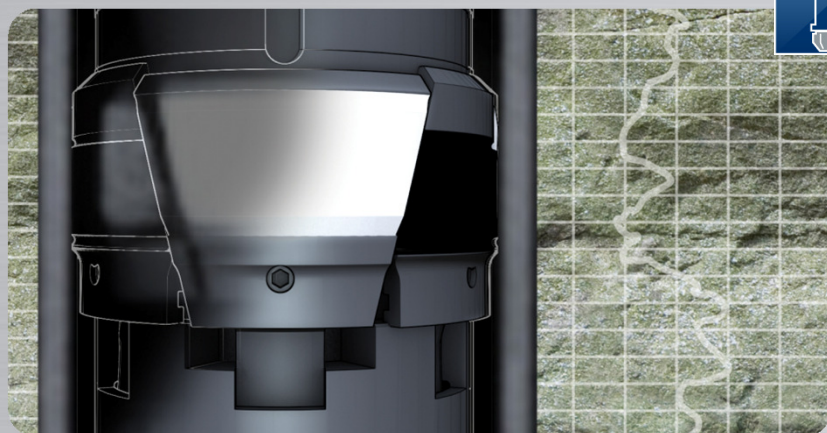


# LIVE

## DIGITAL SLICKLINE SERVICES



- A New Degree of Precision,  
Confirmation and Control on  
Slickline

**Schlumberger**

# Schlumberger Conveyance Portfolio

a wide range of conveyance systems and solutions for customer's well intervention needs

Wireline



Tractor



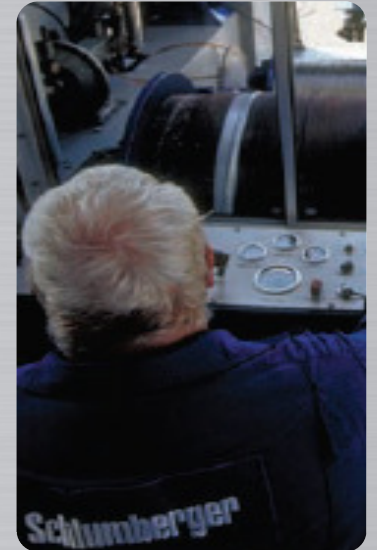
Coiled Tubing



Drill Pipe



Slickline



# Schlumberger Slickline Services 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

# LIVE

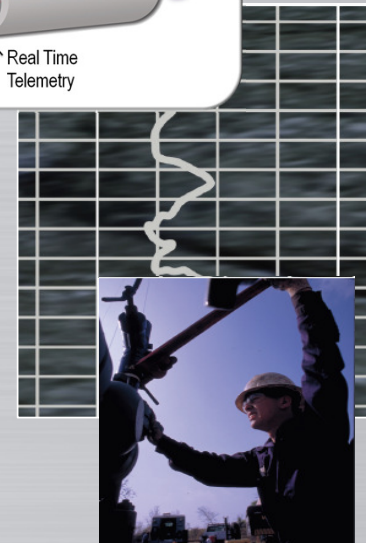
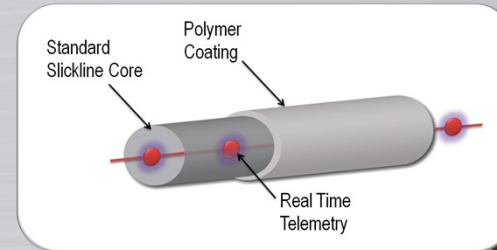
DIGITAL SLICKLINE SERVICES

## 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*



**Schlumberger**

# LIVE Digital Slickline Innovation

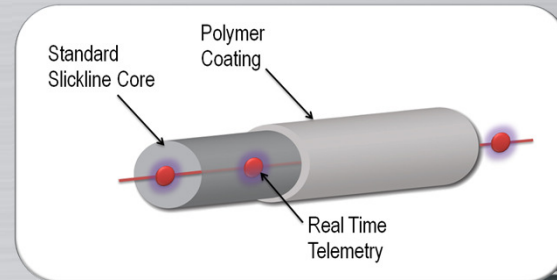
## Digital data telemetry

- 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



# LIVE

DIGITAL SLICKLINE SERVICES



*... all on Slickline conveyance*

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# LIVE Digital Slickline family of services

# LIVE

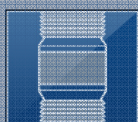
DIGITAL SLICKLINE SERVICES



**LIVE Act**

## Mechanical

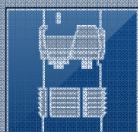
mechanical services, with accurate depth and tool status monitoring



**LIVE Set**

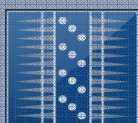
## Remedial

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**

## Measurement

comprehensive production logging with real time measurement and control

 **LONKAR**

**Schlumberger**

# LIVE Digital Slickline Platform

# LIVE

DIGITAL SLICKLINE SERVICES

## DIGITAL SLICKLINE SURFACE EQUIPMENT

- Standard winch / drum / pulleys / stuffing box
- Surface Transceiver and PC

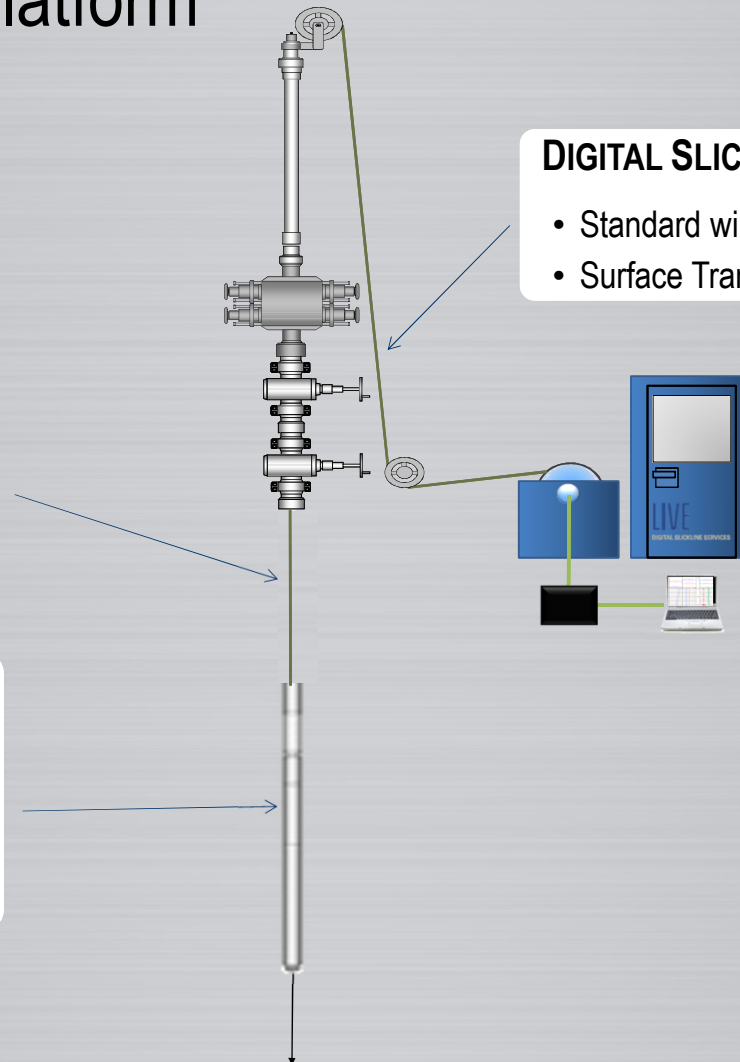
## DIGITAL SLICKLINE CABLE



- Sandvik 5R60 stainless steel alloy
  - 0.108" (0.138" OD after coating)
  - 0.125" (0.153" OD after coating)

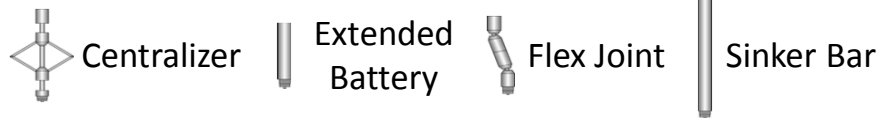
## DIGITAL SLICKLINE CORE TOOLS

- Cable head
- Basic Measurement Cartridge
  - shock / tension / deviation / movement
- Depth Correlation Cartridge (GR/CCL)



# Schlumberger





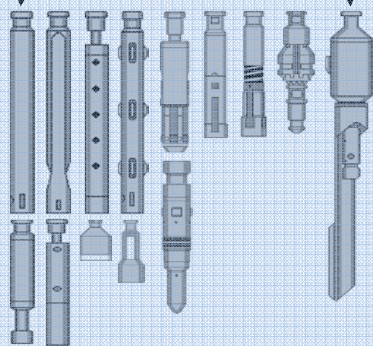
### OPTIONAL ACCESSORIES



### OPTIONAL TOOLS

## DIGITAL SLICKLINE FAMILY OF SERVICES

X'over to  
5/8" SR

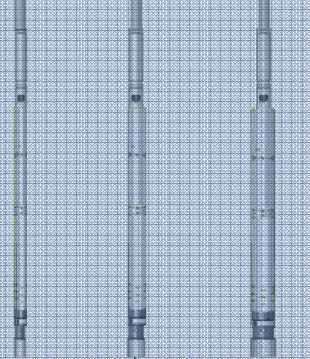


Mechanical  
Slickline Tools



**Mechanical**

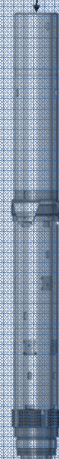
Wired  
Jar



Dset1   Dset2   Dset3



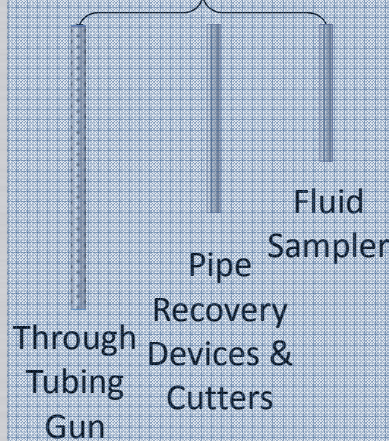
**Remedial**



GeoLock



Surface  
Controlled  
Trigger



Nuclear  
Density   Gradio

Quartz Temperature  
Capacitance

In-Line Spinner

Fullbore  
Mechanical  
Spinner



**Measurement**

# Digital Slickline Technologies – Digital Wire

**LIVE**

DIGITAL SLICKLINE SERVICES

## Commercial wire core

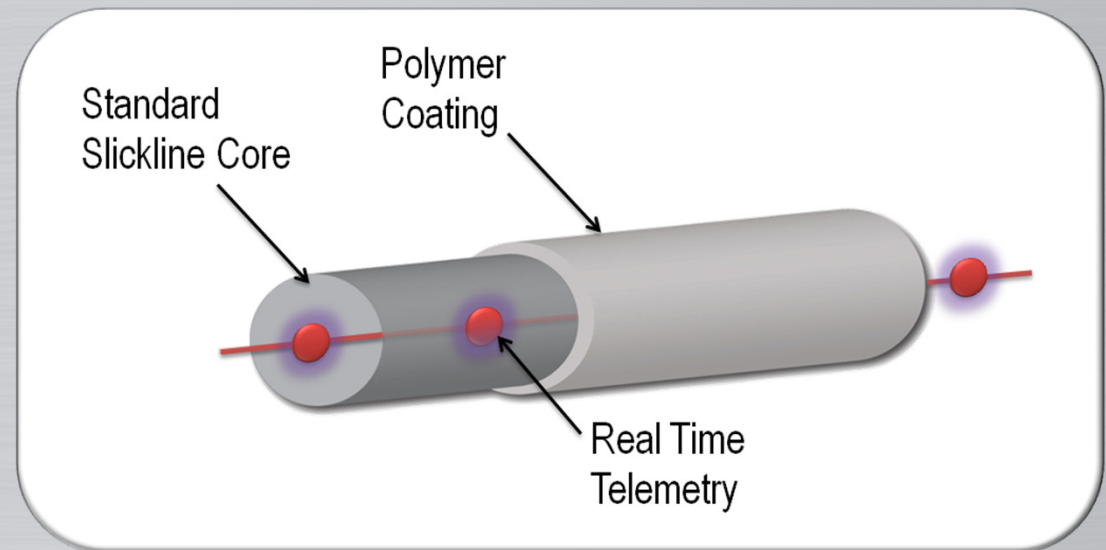
- Sandvik 5R60 Stainless Steel
- 0.108" and 0.125" available

## Insulation Specification

- Proprietary polymer compound
- Non reactive, H<sub>2</sub>S resistant

## Sour Service digital wire

- H<sub>2</sub>S resistant engineering ongoing (28Mo)



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# Digital Insulated Head

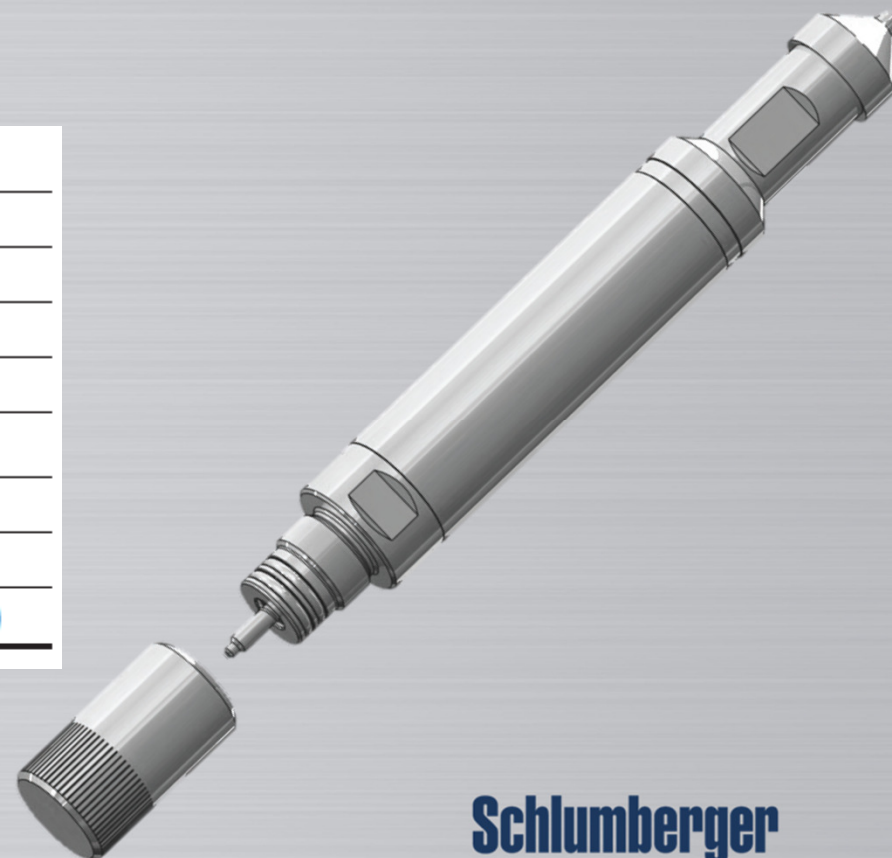
# LIVE

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The digital insulated head provides the mechanical and electrical interface between the digital slickline cable and the downhole tools

## Technical specification

Temperature Rating:	302 degF (150 degC)
Pressure Rating	15 kpsi (103.4 MPa)
Length:	9.8 in (250 mm)
Outside Diameter:	1 <sup>11</sup> / <sub>16</sub> in (43 mm)
Weight:	4.9 lb (2.2 kg)
Service:	H2S service
Bottom thread:	1 <sup>3</sup> / <sub>16</sub> in 12UN (GO type) male
Fishing Neck:	1 <sup>3</sup> / <sub>8</sub> in (engage with 2-in JDC pulling tool)



## Schlumberger

# Basic Measurement Cartridge

- The basic measurement cartridge (BMC) provides the power to all the sensors, as well as the telemetry to send the data from each sensor to the surface at the proper rate. In addition, it receives control signals from the surface transceiver.
- The BMC is equipped with sensors to measure the downhole tension, the well deviation, the internal temperature, and the jarring shock efficiency. Each sensor's data is sent via telemetry to the surface and is also recorded in the memory.

## Technical specification

Temperature Rating:	302 degF (150 degC)
Pressure Rating	15 kpsi (103.4 MPa)
Length:	24.8 in (630 mm)
Outside Diameter:	1 11/16 in (43 mm)
Weight:	10.8 lb (4.9 kg)
Service:	H2S service
Top thread:	1 3/8 in 12UN (GO type) female
Bottom thread:	1 3/4 in 12 Stub ACME (BEST) male
Memory Capacity:	18 h
Sampling Rate:	0.5 s (each data set)
Downhole Tension Scale:	-100–1,000 lbs (-50–500 kg)
Accuracy:	+/- 2% from -50 to 100 kg (+/- 1% from 100 to 500 kg)
Hysteresis:	1% FS
Well Deviation Range:	0–90°
Accuracy:	+/- 1°
Resolution:	0.5°
Shock Acceleration Range:	+/- 250 G
Accuracy:	+/- 2 G
Resolution:	1 G
Internal Temperature Accuracy:	+/- 3.5 degF (+/- 2 degC)
Resolution:	1.5 degF (0.8 degC)

**LIVE**

**DIGITAL SLICKLINE SERVICES**



**Schlumberger**



# Digital Correlation Cartridge

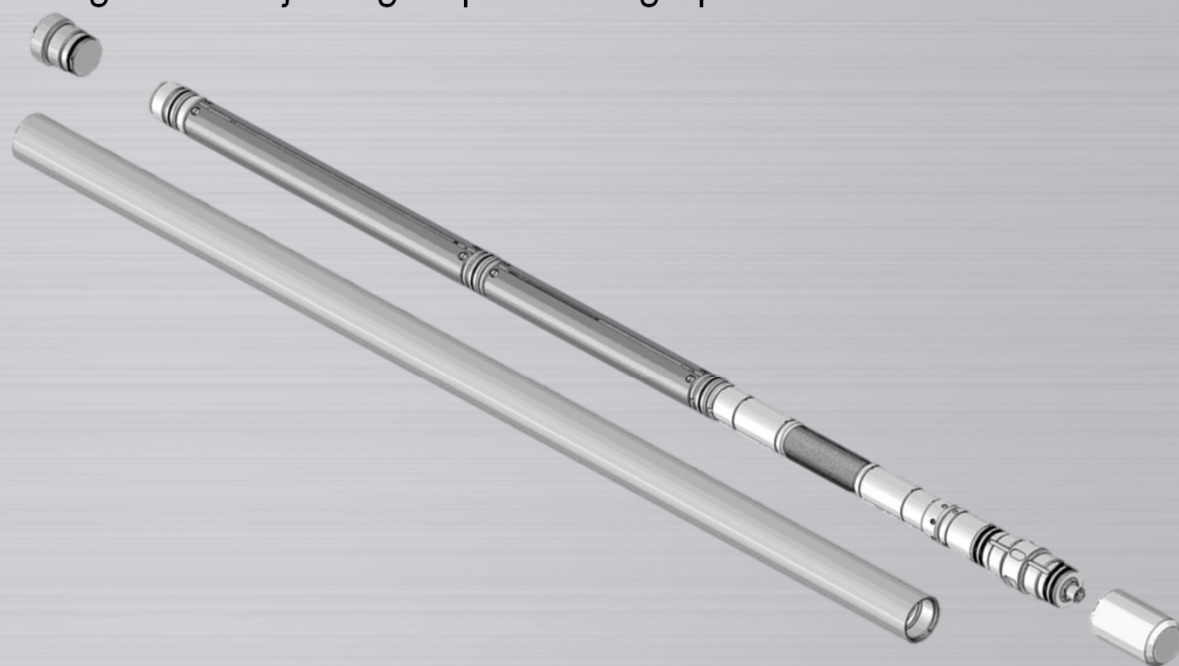
# LIVE

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- The digital correlation cartridge (DCC) provides a digital CCL as well as natural GR detection to enable real-time depth correlation with openhole or cased-hole reference logs. The robust GR detector means this tool can also be used during slickline jarring or perforating operations.

## Technical specification

Temperature Rating:	302 degF (150 degC)
Pressure Rating	15 kpsi (103.4 MPa)
Length:	42.5 in (1,080 mm)
Outside Diameter:	1 11/16 in (43 mm)
Weight:	18.0 lb (8.2 kg)
Service:	H2S service
Top thread:	1 3/64 in 12 Stub ACME (BEST) female
Bottom thread:	1 39/64 in 12 Stub ACME (BEST) male
Memory Capacity:	4.5 d
Sampling Rate CCL	0.05 s (20Hz)
Sampling Rate GR	1.0 s
GR Calibration:	1 count /API
GR Threshold:	20 keV (approx.)
Depth Resolution:	6 in
Logging Speed:	33 ft/min (10 m/min)



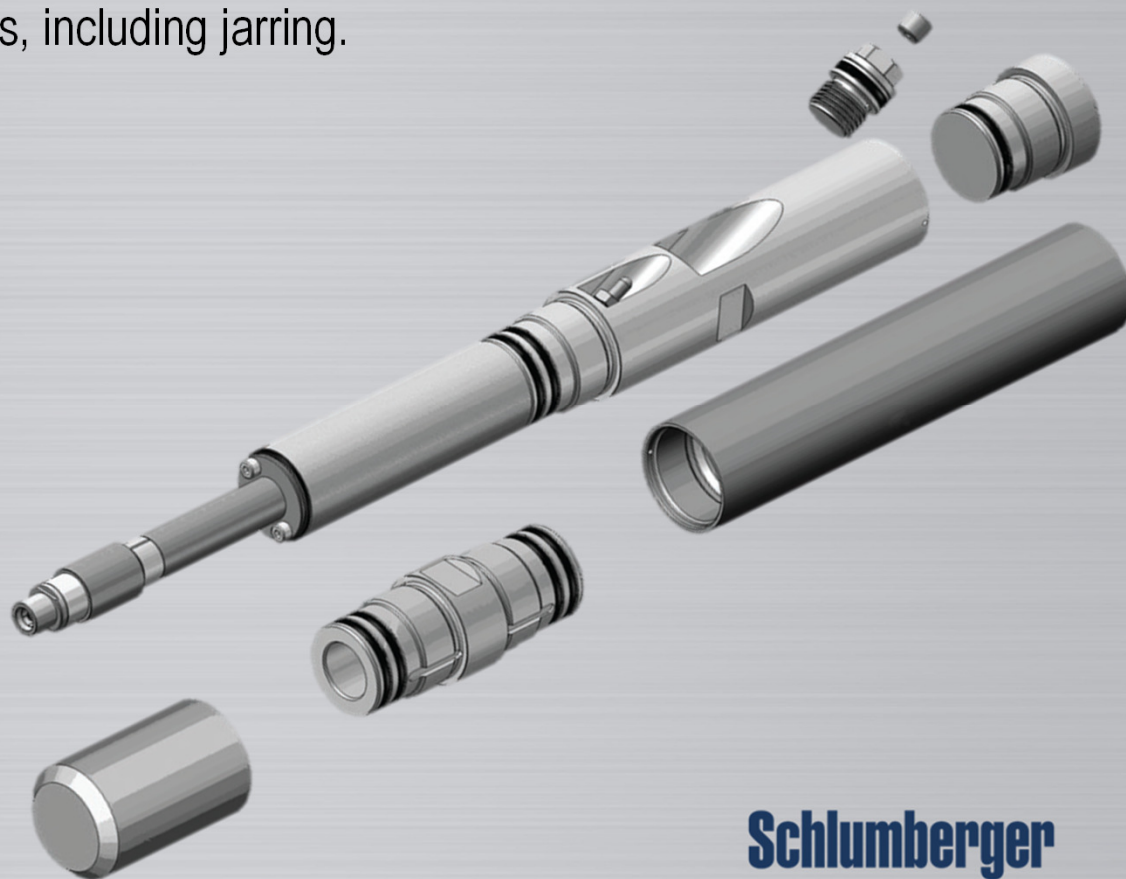
## Schlumberger

# Digital Pressure Gauge

- ❑ The digital pressure gauge (DPG) is equipped with robust sensors to measure the well pressure and temperature during slickline operations, including jarring.

## Technical Specifications

Temperature Rating:	302 degF (150 degC)
Pressure Rating:	15kpsi (103.4 MPa)
Length:	14.6 in (370 mm)
Outside Diameter:	1 11/16 in (43 mm)
Weight:	6.6 lb (3.0 kg)
Service:	H2S Service
Top thread:	1 39/64 in 12 Stub ACME (BEST) female
Bottom thread:	1 39/64 in 12 Stub ACME (BEST) male
Memory Capacity:	12 d
Sampling Rate:	1.0 s (each data set)
Temperature Range:	32–302 degF (0–150 degC)
Accuracy:	+/- 0.54 degF (+/- 0.3 degC)
Resolution:	0.018 degF (0.01 degC)
Pressure Range:	10,000 psi (68,900 kPa)
Accuracy:	+/- 5 psi (34.5 kPa)
Resolution:	0.02 psi (0.14 kPa)



# LIVE

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## Schlumberger

# 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

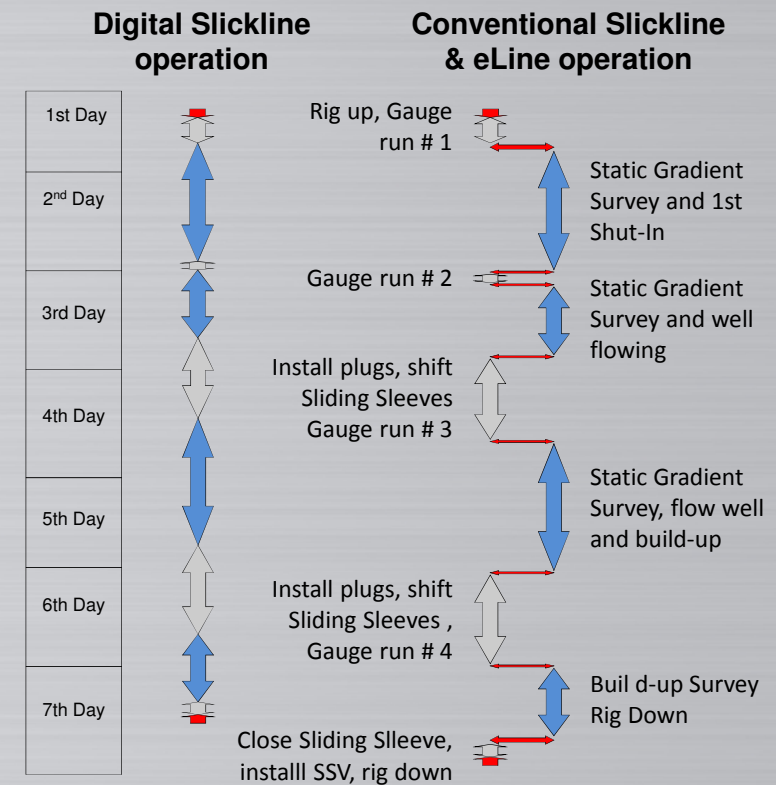
- single unit / crew mobilization
- single rig up / down operation
- pressure control equipment rationalization

## Result

- risk minimization / elimination
- reduction in operational time and deferred production

# LIVE

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# DSL Case Study 2 – Risk Reduction

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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



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# 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?



 **LONKAR**

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