Real-time Telemetric Activation of Slickline Deployed Perforating Guns
AGENDA/INTRODUCTION

SUBTITLE

- Introduction
- Intervention Hardware
- Communication Technique
- System Setup
- Software – Realtime Depth Control
- Real-Time Activation
Introduction

Slickline Perforating History

- Electronic memory triggers introduced into the oilfield in the 90’s
- Reduced the need for electric-line by using slickline conveyance
- Cost reduction for operators

Pro’s

- Small footprint, faster rig-up and running speeds, stuffing box PCE - no grease to maintain pressure seal, reduction in personnel, saved time and cost effective for both operator and service company

Con’s

- Additional correlation run required to achieve semi-accurate depth control
- Very technique sensitive – Human error a common problem
- No correlation data on live run – No actual confirmation of depth control
- If using a timer, trigger could be initiated if winch failed and tool was within parameters
Introduction

Real-Time Slickline

- Bi-Directional Communication
- Real-Time Correlation Data
- Real-Time Activation Control
- Installs on any slickline winch
- Uses a simple slickline rig-up
- Over 1,200 runs with multiple services
  - PLT
  - Perforating
  - Plugs, packers and straddles
  - Pipe recovery
- Operating in the harshest of environments
Intervention Hardware

Surface Equipment

- Drum with Polymeric Coated Wire
- Antenna
- Slickline Stuffing Box
- 20” Upper Sheave (Depth & Tension)
- Winch Display Computer
- Junction Box
- Robust Cabling
- Logging Computer
Intervention Hardware

Polymeric Coated Wire

- Core Diameter 0.125” / Coating thickness 0.0175” / Actual Diameter 0.160”
- Breaking Strain 2500 lbs or 3200 lbs
- Pressure Rated 15,000 psi and Temperature Rated 200 degC

- Chemical resistance
- Abrasive wear resistance
- Explosive decompression
- Stuffing box sealing on wire
- Anti-static properties
- Electrical Properties
- Thermal properties
- Tensile testing wire and cable head
- Fatigue testing wire and cable head
- Impact jarring testing
- Flammability, ignitability
- Toxic gas emissions
Intervention Hardware

Downhole Tools

- Toolstring consists of
  - Cablehead
  - Telemetry module
  - Power processing module with memory and microprocessor
    - Pressure, Temperature, Head Tension, Acceleration, Vibration, CCL and optional Gamma
  - Trigger interface
  - Electronic trigger
  - Mechanical safety switch
  - Firing Head (Can initiate almost any oilfield detonator)
- Battery operated
- Can withstand the most severe shock loading
- Can communicate through 30,000ft of line
- All data is stored to memory
Communication Technique

Coupled Technology

- Bi-Directional Data Tx Rx
- No slip-ring on the drum
- Communication is directly through the base wire
- Does not rely on contact to the casing
  - Communication will never be lost in these environments
    - Scale, wax, corrosion, asphaltene, plastic coated pipe etc.
- Can run in any fluid types
- Communication is still possible with damaged coating
System Set-Up

Real-time Telemetric Activation of Slickline Deployed Perforating Guns
Software
Perforating Module

- Constant data stream
- Calculates CCL stop depth relative to top shot
- Software lockout minimises off depth perforating
- Toggle between depth and time domain
- Sensor sample rate can be increased prior to initiation
  - Acceleration and Vibration give reliable indication of initiation
  - Pressure and Temperature give invaluable reservoir data
- API log can be exported
- LAS file can be exported
Real-Time Activation

Software / Firmware Safety Features

- Dynamic password protected
- Lockout parameters
  - Pressure, temperature, depth and inclination
- Trigger is a dumb tool until on-depth (Memory in blank)
- Tool is programmed from surface
- Unique firing code is sent
- Triple microprocessor within trigger analysis firing code
- All three microprocessors must agree before firing
- Memory is erased directly after initiation
  - Dumb tool always received to surface

Hardware Safety Features

- Mechanical safety switch
  - Pressure and temperature
Real-Time Activation

Real-Time Activation of 20ft, 2 7/8” Gun String

- Good Indication
  - Pressure
  - Temperature
  - Vibration
  - CCL

![Graph showing real-time activation parameters](image)
QUESTIONS?
THANK YOU!

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