Long Gun Deployment Systems

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Wireline – **Deployment Risk Management**

- **Reduce Risk**
  - Pre-job planning highlights operational risk
  - Risk mitigation technologies are selected
  - Operation is carried out
  - Post-job review – identify lessons learned

- **Reduces Cost**
  - The DRM process has resulted in significant cost savings and reductions in NPT.
  - Significant reduction in perforating runs & stuck or fished toolstrings
  - Deployment Risk Management has allowed wireline conveyed services to replace more expensive and time consuming methods.
Wireline – Case Study

• The Perforating Challenge
  • 21,200 ft MD
  • 14,000 ft Step Out
  • 10,600 ft long 79° tangent
  • Sidetrack at 12,000 ft increased tortuousity issues.
  • $H_2S$ & $CO_2$ present in formation fluids
  • 340 ft interval
  • Weak Sand required oriented perforations

• Standard Approach
  • Shoot oriented guns on coiled tubing, kill & pull due to high angle and short sump.
DRM Approach

- Modeling showed that gun string could be deployed without the tractor as long as flywheels could reduce friction by at least 50%. Past history showed this to be possible.
- At 20,000 feet, cable compression (drag), not tool string friction could prevent the assembly from reaching bottom.
- High predicted pull out (>18,000 lbs) force required a powered capstan as a contingency.
Wireline – Case Study

• The DRM Approach
  • 4 x 2 7/8” HOPS 10°/350° 6spf wireline runs
  • 140 ft, 1,700 lb tool strings, (limited by derrick)
  • Tractor for contingency.
  • Powered Capstan for contingency if release from weak point is required.
  • .490” Ultra-Strength Crush Resistant Wireline
  • Flywheels
  • ART (Addressable Release Tool)
  • V1000 Inhibited Grease for H2S protection.
Powered Capstan

- Maintains constant cable tension on winch drum
- Operator friendly package design
- Allows deep deviated high tension wells to be managed
- Reduces rig down time
- Improves cable life
- Reduces conductor failure
- Improves productivity
- Eliminates drum crush
- Adds to wire line safety
- Cable head can be retained for speedy rig up
- Capstan and Power Pack both rated Zone 1

SLAP-06
Addressable Release Tool

- Designed for use with high voltage devices.
- Can be run above and below the tractor.
- Can be run with a shock absorber for ballistic operations.
- Released via a specific operator selected digital code from a surface control box.
- Up to 7 ART’s can be run in a single string.
Cable Size  .474”
Wt in fluid (lbs)  1026 lbs/1000m
Breaking strength  23,600 lbs
Tool weight  1,000 lbs

**Weakpoint**
Stud Size  6,000 lbs
Cable Safety Factor  65%

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Flywheels

1. Aid perforating guns’ deployment in highly deviated or difficult well bores
2. Enable reliable wireline deployment at high deviations
3. Reduce the conveyance sensitivity to:
   • Serpentine Boreholes (long-winding turns and multiple doglegs)
   • Debris (cement or mud remnants, fill)
   • High Frictional Loss Areas (corrosion, scale, burrs)
Flywheels

- Can reduce friction in the gun string by up to 60%.
- Placed every 40 to 60 feet.
- Allows deployment at up to 84°.
- In some applications, flywheels can be placed on the wireline to further reduce drag.
Typical Long String Hook Up

- Up to 250 ft. of 2 7/8” self orienting guns successfully deployed on wireline.
- Addressable Release Tool
Case History

North Sea Client looking to reduce cost on large workover project.

• Initial re-perforating planned with coiled tubing unit.
  • Estimated 24 hours to deploy and recover 190 feet of 2 7/8” spf guns.

• Using the DRM approach, the gun assembly was deployed on wireline in less than 8 hours, cost savings to the client $400,000.00
Gun Brake System

The time spent on completions can be reduced by using the Gun Brake to run longer and heavier lengths of perforating guns on wireline.

- Perforate long intervals with one run
- An underbalance perforating system for longer intervals
- Reduce the amount of rig time due to elimination of multiple gun runs
- Help alleviate the mechanical forces on rope sockets and wireline during perforating of large gun sizes and/or long gun lengths.
Job Example:
Perforate 200’ of 4-5/8” 16 SPF

- Standard w/l job = 5 runs at 2.5 hrs per run
  - 12.5 to 13 hours of rig time

- Gun Brake job
  - 1 run at 3.5 hr

\[
\text{Time Savings} = 9 \text{ hrs} \ (9*\$)
\]

Ex.

\[
\text{$33,000 / hr} \quad \text{\$297,000.00 in savings}
\]
Examples of the Savings

Venice, USA
EPL, Bay Marchand
- 109 ft long, 3-3/8", 12 spf, perforating gun assembly was wireline conveyed into a well.
- Operating Time – 7.0 hours. (*½ the time compared to a TCP operation*)
  - *Money Saved: $17,500 USD*

Brazil
Macae, Brazil
Albarcora Field, Brazil
- 145 ft long, 4-1/2", 12 spf, DP charges, 145 ft gross and 110 ft net interval, conveyed into a 11,500 ft deep completion.
- Operating Time - 6.5 hours, estimated rig time for conventional wireline was 30 hours.
  - *Money Saved: $100,000 USD*
Job History

• Offering the service since 2005 for North Sea Operations.
• Longest deployment to date, 330 feet (100 metres) of 3 3/8’ (86 mm) 6 spf (20 spm) carriers.
• Typical deployment: up to 250 feet (76 metres) of 2 7/8” (73 mm) 6 spf (20 spm) carriers.
• Average rig time saving over conventional coiled tubing or TCP deployment, up to 72 hours.
• System is compatible with Dynamic Underbalance Operations where applicable.
• Can be fitted with Snap Shot® inter-gun release devices for deployment and recovery under pressure.
Applications

• Vertical or low angle wells with little/no sump
• High angle wells where TCP guns won’t drop
• Replacement for standard wireline deployed guns where the interval is long – reducing runs
• Through tubing re-perforating in existing wells
• Through tubing perforating in new wells