Long Gun Deployment Systems
IPS-12-28

Presented by Margarita Farinango, Baker Hughes
Jim Gilliat, Baker Hughes

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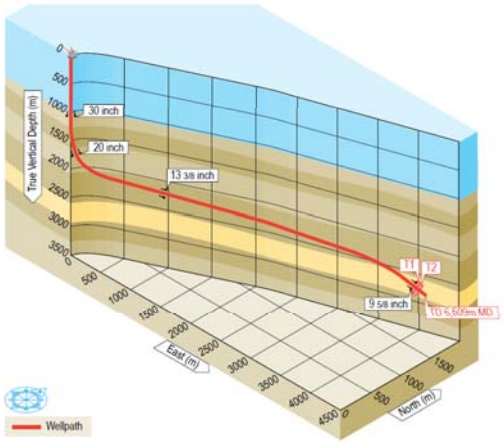
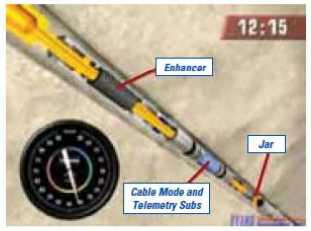
Wireline – Deployment Risk Management

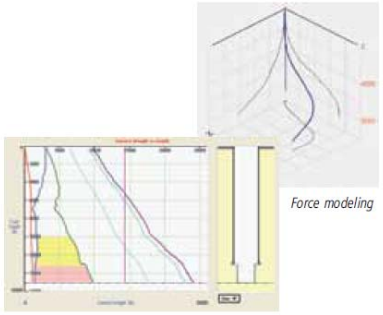




Wireline jars

Releasable cablehead

Low-friction roller stand-offs

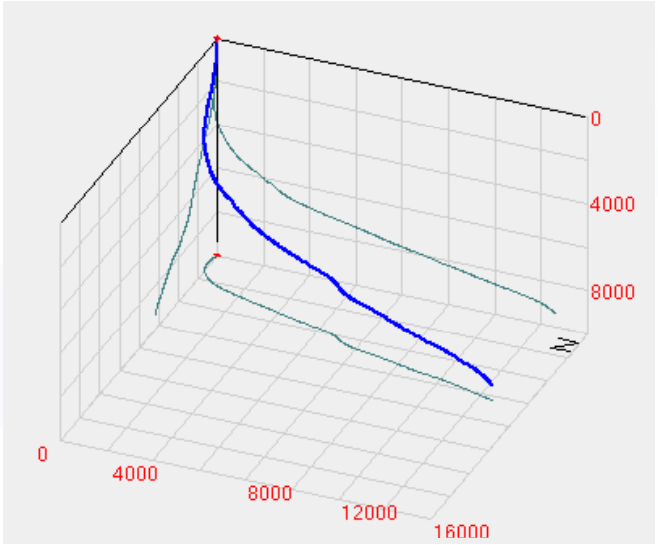


Force modeling

- **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.

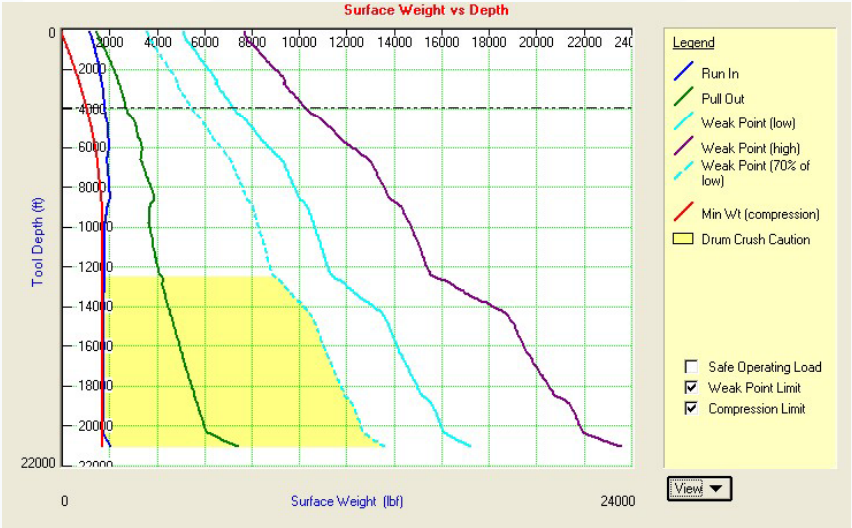
Wireline – Case Study

- **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.



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Powered Capstan

- Assist wireline unit with up to 9,000 lbs of additional pulling force.
- Positioned in the derrick to relieve load on sheaves and winch unit.
- Assures uniform torque and tension on the wireline reel regardless of forces ahead of the capstan.

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Addressable Release Tool

- Designed for use with high voltage devices such as tractors.
- 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.

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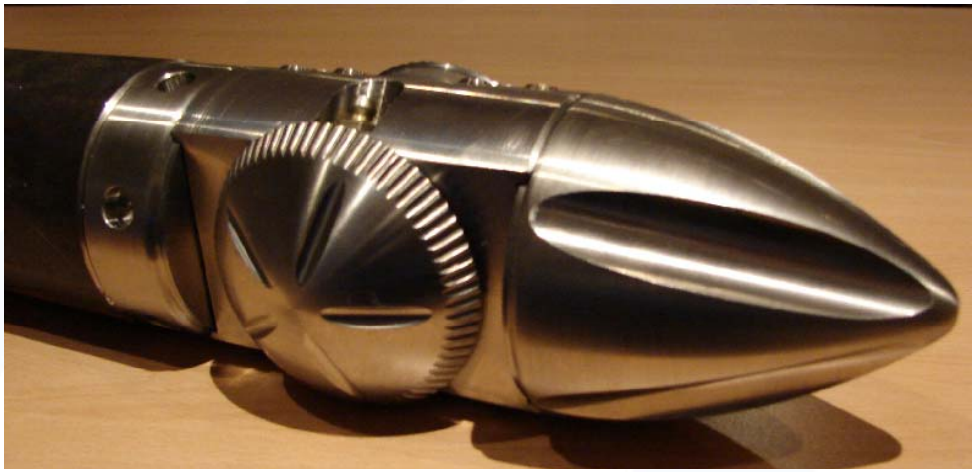
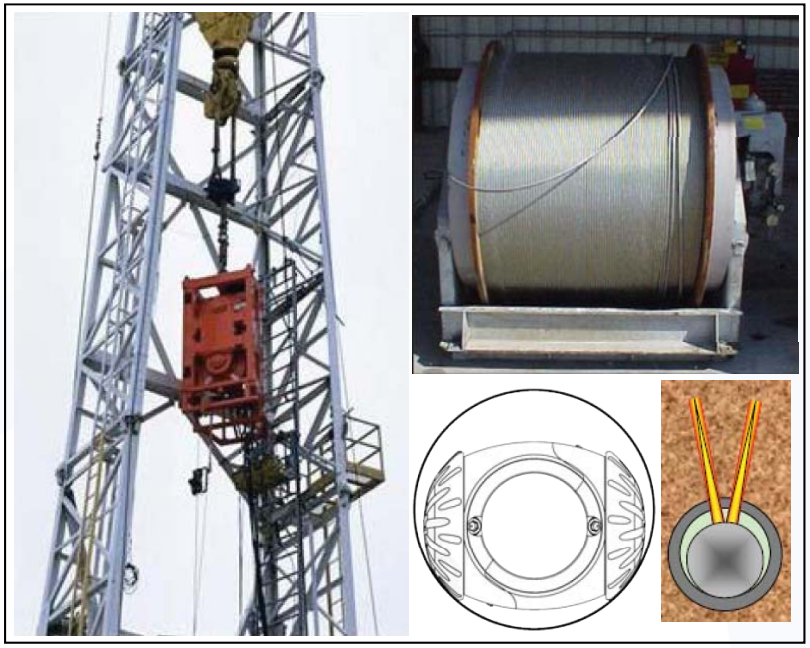
Flywheels

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)



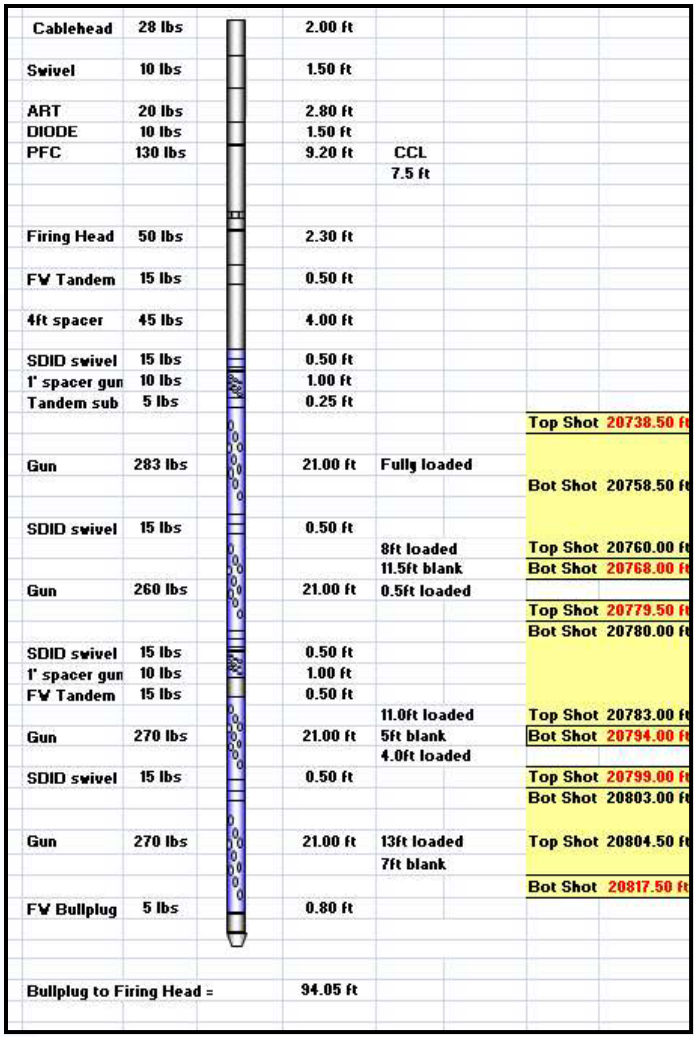
Wireline – Case Study

- **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 H_2S protection.



Typical Long String Hook Up with HOPS™

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



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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.

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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