PowerReach Service: Hybrid Coiled Tubing & Jointed Pipe Technology

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Challenges to Well Intervention

On Surface
- Size and Weight Restrictions
- Reel Capacity
- Foot Print

Downhole
- Lockup
- Drilling Plugs
- Wellbore Cleanouts
- Multi-zone Stimulation
Transportation Size and Weight Limits

- Width Limits
- Height Limits
- Length Limits
- Weight Limits
Coil Tubing Reel Capacity

The image shows a graph illustrating the coil tubing reel capacity for different sizes of coils. The graph plots the capacities (in feet) against the standard flange OD (outside diameter) for various coil sizes:

- 1-in. Coil
- 1.25-in. Coil
- 1.5-in. Coil
- 1.75-in. Coil
- 2-in. Coil
- 2.375-in. Coil

The capacities range from 0 to 70,000 feet, and the graph indicates how the capacity changes with different standard flange OD values.
Coil Tubing Lock-up

Coil tubing is more prone to lock-up if:

- Applied to highly deviated or horizontal wellbores
- Applied to wells with high dogleg severity
- Using smaller coil tubing
Drilling Plugs

Limitations to drilling plugs:

- Inability to reach target depth on long, extended wells
- Inability to apply sufficient weight and torque at the bit to drill.
Wellbore Cleanouts

Limitations to wellbore cleanouts:

- Small-OD coil is more prone to lockup
- Small-OD coil limits flow rate
- Long coil lengths present a large capital investment
Multi-Zone Stimulation

Limitations to multi-zone stimulation:

- The fluid flow rate pumped is limited by pressure and velocity (pumping proppant).
- Remedial options are limited because of rate constraints, increasing risk, and reducing operational efficiency.
Current Solutions

- Jointed Pipe
- Optimal Taper and Pipe Size
- Drag-Friction Reducing Fluids
- Mechanical Deep-Reach Aids
Jointed Pipe

Limitations to of Jointed Pipe:

- Slower pipe-running speed compared to using CT
- Personnel in work basket while moving pipe
- Cannot circulate fluid continuously while making up pipe joints
- Remedial options are restrained
Tapered Coil Tubing

Limitations to of Tapered Coil Tubing:

- Limited flow rate
- Restricted by reel capacity
- Design constrained by local weight and height restrictions
- High cost
- Specially set up injector
Friction Reducing Fluids

Limitations to Friction Reducing Fluids:

- High cost
- Possible modeling inaccuracies when determining concentrations
- Compatibility issues
- Logistics
- Human error when mixing and pumping
- Quality control
Mechanical Aids

Limitations of mechanical deep-reach aids:

- High cost
- Compatibility with proppant-laden fluids
- Tractor dimensions will limit pump rates
- Not applicable to all CT applications
- Reliability and vulnerability to hole conditions may be problematic
Hybrid System

Winner of the 2010 World Oil Award For Best Completion Technology
Hybrid System – What is it?

- Gooseneck
- Tower
- HWO Rig Assist Unit
- Reel Trailer
Hybrid System – What does it do?

- HWO unit runs jointed pipe and CT
- Rig-less operation
- Well control package – no wireline
- Deeper penetration before lockup
- Higher pull/push capacity
- Can apply more force at TD for drill-outs
- Enables higher pumping rates
- Forward and reverse circulation
- Safe and effective operations
- Cost saving
Hybrid System – Where can it be used?

- Multi-zone stimulation
- Wellbore cleanout
- Drilling
- Remedial cementing
- Gravel packing
- Cutting windows
- Conformance
- Screen repair
- Fishing operations
- Well control
Well Control Safety Valves

- Coil Tubing
- Coil Tubing Connector
- Quick-Connector
- Surface Activated Safety Valve
- Jointed Pipe

Closed Position

Open Position
Coil Tubing vs. Hybrid System

Deep Well 1

• 10 3/4-in. casing to 8,368 ft MD
• 7-in. liner to 18,368 ft MD (TD),
• Lateral from 9,500 ft MD to TD.

Solution

• Coil Tubing: 18,420 ft of 1 3/4-in. CT to TD
• Hybrid: 10,080 ft of 2 3/8-in. CT can be run in conjunction with 2 3/8-in. jointed pipe to TD
Coil Tubing vs. Hybrid System

Deep Well 2

- 5 1/2-in. casing to 16,000 ft MD
- Lateral from 9,573 ft MD to TD.

Solution

- Coil Tubing: Using 1-3/4-in. CT, even after manipulation of the friction factor to simulate friction reducing aids, target depth could not be reached.
- Hybrid: 10,000 ft of 2 3/8-in. CT run in conjunction with 2 3/8-in. jointed pipe can be used to reach target depth.
Pinpoint Stimulation
What can you do with two flow paths?

- Efficiently place single fracs
  - Rate per interval
  - Fracture/proppant placement
  - Reduced HHP requirement & footprint

- Circulate
  - Hydraljet perforate
  - Re-perforate
  - Spot acid/pad/treatment
  - Zero flush
  - Cleanout premature screenout

- Manage screenout risk
  - More aggressive frac designs
  - Higher proppant concentration
  - Larger proppant
  - Place higher conductivity
  - Shorter ramps, less fluids, less time

- Downhole Mixing
  - Higher rates
  - Real-time prop conc control at perfs
  - Real-time reservoir response
  - Far-field diversion

- Zonal isolation
  - Sand plug setting
  - Dynamic diversion (Bernoulli effect)

- Dead-leg Pressure Interpretation

ICoTA
Increase Stimulated Reservoir Volume

Brinell Hardness
Fracture Intensity in Ductile Rock

CobraMax HJA

- Improves the process of setting proppant plugs to isolate intervals
- Reduces the time between intervals of a multi-stage fracturing treatment
- Improves Hydra-Jet service performance
Reservoir Diversion in Moderately Brittle Rock

CobraMax® DM
CobraMax DM Benefits

Benefits

• **Low Risk:**
  – Ability to prevent screenouts and rapid screenout recovery.

• **Operational efficiency:**
  – Complete job & cleanout in one trip.
  – No need to drill out plugs
  – Reduce footprint on location

• **Stimulation effectiveness:**
  – Customize every fracture treatment – respond to the rock.
  – Accurately place every fracture.
  – Place proppant accurately and deeper into the reservoir.
  – Maximize near wellbore conductivity – no overflushing.
  – Induce far-field reservoir diversion to increase stimulated reservoir access.
Stress Induced Complexity in Brittle Rock

Reduce or possibly reverse the stress anisotropy in brittle rock by applying alternating sequence fracturing.

- Individual interval treatments using mechanical shift sliding sleeve
- Optimize fracture treatment using downhole mixing
- Accurate proppant placement
- Low contingency cost
Alternate Sequence Fracturing

Main Bi-Wing Fracture

Stress Relief Fractures

Mechanical Shift Sliding Sleeves
Delta Stim Completion

Frac 1
Alternate Sequence Fracturing

Fracture Complexity Resulting From Low Stress Anisotropy
Multi-Zone Stimulation Using PowerReach

- Maximize Stimulation Reservoir Volume.
- Reduce overall completion time.
- Customize every fracture treatment.
- Accurately place every fracture.
- Place proppant accurately into the fracture.
- Maximize near wellbore conductivity.
- Reduce Risk of Excessive Non-Productive Time.
PowerReach Conclusions

- Reach deeper deeps before lockup
- Gain the efficiency of coil tubing at deeper depths
- Reduce completion time by hanging jointed pipe
- Provides complete well control
- Higher flow rates can be achieved
- More weight on bit can be applied
Questions?