New Method for Tubing Conveyed Perforating Long Intervals with Improved Reliability

2019-NAPS-5.3
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Pressure Pulsed Perforating

New Method for Tubing Conveyed Perforating (TCP)

- Enables perforation of multiple clusters in Horizontal Wells with existing perforations
- Eliminates need for blank spacer guns on long intervals in Vertical or Horizontal Wells
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Historical Methodology for Horizontal Recompletes

Time Delay Perforating System on Coiled Tubing

Loaded Gun

Blank Guns

Loaded Gun

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System Operation

Donor Gun
Pressure Chamber
Spacer Tubing

Spacer Tubing
Differential Firing Head
Receiver Gun

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Field Test Results

- Field Tests – North Dakota
  - 100% Success on 4 Wells
  - 21,000 foot Horizontal Wells in Bakken formation
  - 4,400 PSI hydrostatic pressure
  - Toe stage perforated after sliding sleeve failure
- Well #1
  - 3 Successful transfers
- Well #2-4
  - 6 Successful transfers
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Field Trial Results

- Field Trial – Permian Basin
  - 100% Success
  - Horizontal Well – Bottom shot @ 14,208’
  - 5,400 PSI hydrostatic pressure
  - 11 Successful transfers in a single run
  - Over 200 existing perforations in Well
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Field Trial Results

- Field Trial - California
  - 100% Success
  - Vertical Well
  - 4 Runs in various hydrostatic pressures
  - 15 Successful transfers
  - Maximum of 9 transfers in one run
  - Various transfer intervals
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Benefits - Horizontal Wells with existing perforations

- Perforate all clusters in one trip
- All guns are properly positioned when first gun fires
- Improved efficiencies
  - Time (cost) savings for deployment and retrieval
  - Eliminates need to mobilize coiled tubing
  - Eliminates need for time delay fuses
Benefits- Long blank intervals

- Improved operational efficiencies
  - Faster deployment and retrieval of perforating guns
  - Fewer man hours to prepare blank guns
  - Less weight and volume to transport to and from location
  - Fewer man hours to clean up blank guns after the job

- Lower costs
  - Time savings
  - Tubing spacers replace costly blank guns
  - Improved reliability eliminates stop fires
Conclusions

- 100% Success in Field Tests and Field Trials
- Successfully shot multiple clusters in Horizontal Wells with existing perforations
- Eliminates need for blank spacer guns on long intervals in Vertical or Horizontal Wells
QUESTIONS?
THANK YOU