INSTRUMENTED DOCKING PERFORATING GUN SYSTEM

Field experience results

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AGENDA

- Perforating Optimization Workflow
- Safety Moment
- A Novel Perforating System
- Field Experiences
- Summary
PERFORATING OPTIMIZATION WORKFLOW

Specific Perforating Requirements
Reservoir connectivity
Perforations’ cleanup and Protection
Operational Aspects

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SAFETY MOMENT

Wellsite Surface Detonation Events

*Data from International Perforating Forum https://perforators.org/

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Safety Moment

Wellsite Surface Detonation Events

50% occur by inadvertent application of power
Using addressable systems mitigates the biggest risk

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SAFETY MOMENT

Wellsite Surface Detonation Events

- 50% occur by inadvertent application of power
- Using addressable systems mitigates the biggest risk
- Modular Design, RF Filter, ESD protection, Secondary explosive, High power

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A NOVEL PERFORATING SYSTEM

Docking Gun Module

Advanced Measurement Module

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A NOVEL PERFORATING SYSTEM

SAFETY
- API RP67
- RF Safe Operations
- New Safety Placard

EFFICIENCY
- Arm in Advance
- Selectivity
- Maximized Payloads

RELIABILITY
- Engineered design
- Fewer misruns
- Elimination of port plugs, wiring and Shock Absorber

PRODUCTIVITY
- Fast Pressure Gauge
- Gun Shock Fluid Level
- Hydrostatic Pressure

COST PER BARREL
- Rig-Time Savings
- Reduced Police Escorts
- More Interventions

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FIELD EXPERIENCES – Operational Statistics Ecuador

- Total # of runs: 151
- Maximum # of runs per job: 7
- Heaviest Tool string: 1,980

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Field Experiences – REST OF THE WORLD

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ADVANCED MEASUREMENTS MODULE – Dynamic measurements WHILE perforating

Conventional Perforating
Peak Shock: 12,000G
Max. Pressure: 7,000 psi
Min. Pressure: 3,000 psi

Stand Alone Dynamic Underbalance
Peak Shock: 8,800G
Max. Pressure: 4,000 psi
Min. Pressure: 800 psi

Perforating assisted propellant
Peak Shock: 13,000G
Max. Pressure: 10,000 psi
Min Pressure: 5,200 psi
Real time dynamic underbalance measurements are compared with the simulation results getting a confirmation of a dynamic underbalance in the order of -1,400 psi.
ADVANCED MEASUREMENTS MODULE – Dynamic measurements for productivity estimations

Differences were found between the simulated values and the measured data.
ADVANCED MEASUREMENTS MODULE – Dynamic measurements for productivity estimations

Simulation was re-run adjusting the real opened interval (23 ft instead of 14 ft) and the revised formation permeability (From 30 mD to 25 md)

Reservoir Pressure: 4,000 psi

Data Match – Propellant Stimulation

Wellbore Pressure (psi)

Time (msec)

Measured Data
Simulated Data

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ADVANCED MEASUREMENTS MODULE – Dynamic measurements for productivity estimations

With the adjusted parameters the fracture length was simulated again: 3.5 ft to 6 ft and the productivity results were adjusted.
In Oman, real time BHP measurements were used to ensure enough confinement pressure before propellant stimulation in low reservoir pressure wells.

In Saudi, pressure measurements while running in hole showed poor mud displacement in front of the interest zone and allowed the operator to improve its procedures minimizing formation damage risk.

Reservoir Pressure: 15,000 KPa
Extreme wireline deployments in offshore environments have reached world record. In brownfields where the rigs, location and budgets are smaller, the docking gun system enabled the ability of conveying 4 ½” gun strings longer than 40 ft (Up to 70 ft) and brought 33% time savings in a 10 well campaign in Ecuador.
SUMMARY

Safety
- More than 300 runs worldwide in various types of locations

Efficiency
- Time reductions in the order of 33% in brownfield applications

Reliability
- No misruns
- Operations up to 350 degF, 20kpsi
- No shock absorber
- Tractor and electrical coil tubing

Productivity
- Real time verification of wellbore conditions for propellant stimulation, completion fluid displacement control, simulations’ validations and productivity estimations

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QUESTIONS?
THANK YOU
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