Update on Tractor Conveyed Ballistics
Including API RP-67 Revision

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Outline:

- The Downhole Tractor - Briefly
- Tractors in the Industry
- The Perforating Safe Sub
- One Case History from Oman
- API RP-67 Revision
- Summary
First Perfo Gun fired on a tractor was for BP Alaska ‘96
First Bridge Plug set on a tractor was for Statoil in ‘97
First Back Off on a tractor was for Shell UK in ‘98
Since then there has been approx 12,000 ballistic runs on downhole tractors
Tractor Tools by Type

Total = 754 Tractors
Tractor sizes that have conveyed ballistics
Tractor Tools by Company Split

- Company A: 51%
- Company B: 34%
- Company C: 9%
- Others: 6%
Ballistics account for 41% of all Tractor conveyance Runs.
Example of a Perforating Tool String

CH Swivel  CCL  Tractor

Safe Sub  Shock Absorber  Perforations; 20 ft of 3 3/8” Guns
These subs have two independent motorized relays that are operated by two-way communication with the surface panel. Position of the relays are positively confirmed by the field engineer in both open and closed positions.

They are built with two independent barriers that will prevent unintended voltages from reaching a ballistic while the sub is in “Safe” mode. When in “Perf” mode it will allow two way status communication to pass through.

NOTE: Feed thru relay in the Tractors opens during the power sequence cutting off continuity to the gun-string.
Case History: Oman Multi Run e-Line Perforating

- Oman client had 100 m of 2 7/8” perforating guns to shoot
- Chose Tractor because horizontal well – Max inclination: 94 deg
- TD = 1549m
- Total tractor runs: 16 (no misruns)
- Dummy run and CBL run
- Total accumulated tractor distance: 3447m
- Total time tractoring: 40.5 hours
- Total job time: 14 days included fishing days
- Tool string came off after well was opened up by mistake
- Job was considered a success
A customer in Eastern Alberta utilizing temperature logging identified cold formation areas in a cyclic steam well.

Perforations were required at various points throughout the horizontal section.

A tractor was selected to convey 32 select fired oriented perforating guns in 1 run. Each gun is equipped with its own detonator, to selectively fire.

**Well Data:**
- Total Measured Depth: 1800m
- Horizontal Section: 1200m
- Total meters Conveyed: 1314m
- Total payload conveyed: **885kg /1950lb**
- Total tool-string length: **35 meters**
- Gun diameter: 86mm/ 3-3/8”
- Tractor Conveyance time: 2:35h
- Personnel on site: 2 +2
6.7 Electric Downhole Tractors

Previous version:
A multi-point failure analysis shall be completed for any downhole tractor to be used with explosive devices. A downhole tractor may only be used if this analysis confirms that no single-point failure will cause or permit tractor voltage to be applied to the explosive device. There shall be at least one independent electrical isolation device between the tractor and the explosive device, and the isolation device shall have a voltage rating greater than the potential output of the tractor. Each electrical isolation device design should be validated by an independent, recognized testing agency through a multi-point failure analysis. Only high voltage initiators such those described in Para. 6.3.1.2, 6.3.1.3, and 6.3.1.4 shall be used when conveying explosive devices on an electric downhole tractor.
6.7 Electric Downhole Tractors

**New proposed version**

Downhole tractors, as defined in Section 3, Terms and Definitions, are considered a downhole power source (Section 6.5.1). Downhole tractor electronics and motors are energized with voltages potentially high enough to cause an attached detonator or initiator to be fired. Two purpose designed safety barriers that shall each be independently tested, must be in place between the tractor electrical circuitry and the attached explosive components.

The tractor system, and the two barriers can be used with explosive devices only if a multi-point failure analysis by a recognized third party, has been completed on each of these three items. This analysis must confirm that no single-point failure will cause or permit tractor voltage to be applied to the explosive device.
Summary

• Downhole Tractors come in several shapes and sizes and cover the globe

• Tractors have a strong track record conveying ballistics (>12,000 runs)

• Perforating Safe Subs with 2 barriers that can be independently tested are recommended for ballistics operations on Tractors

• One Case History from Oman demonstrates the reliability of tractors

• API RP-67 revision standardizes numbers of safety barriers and clears up confusion around detonators