

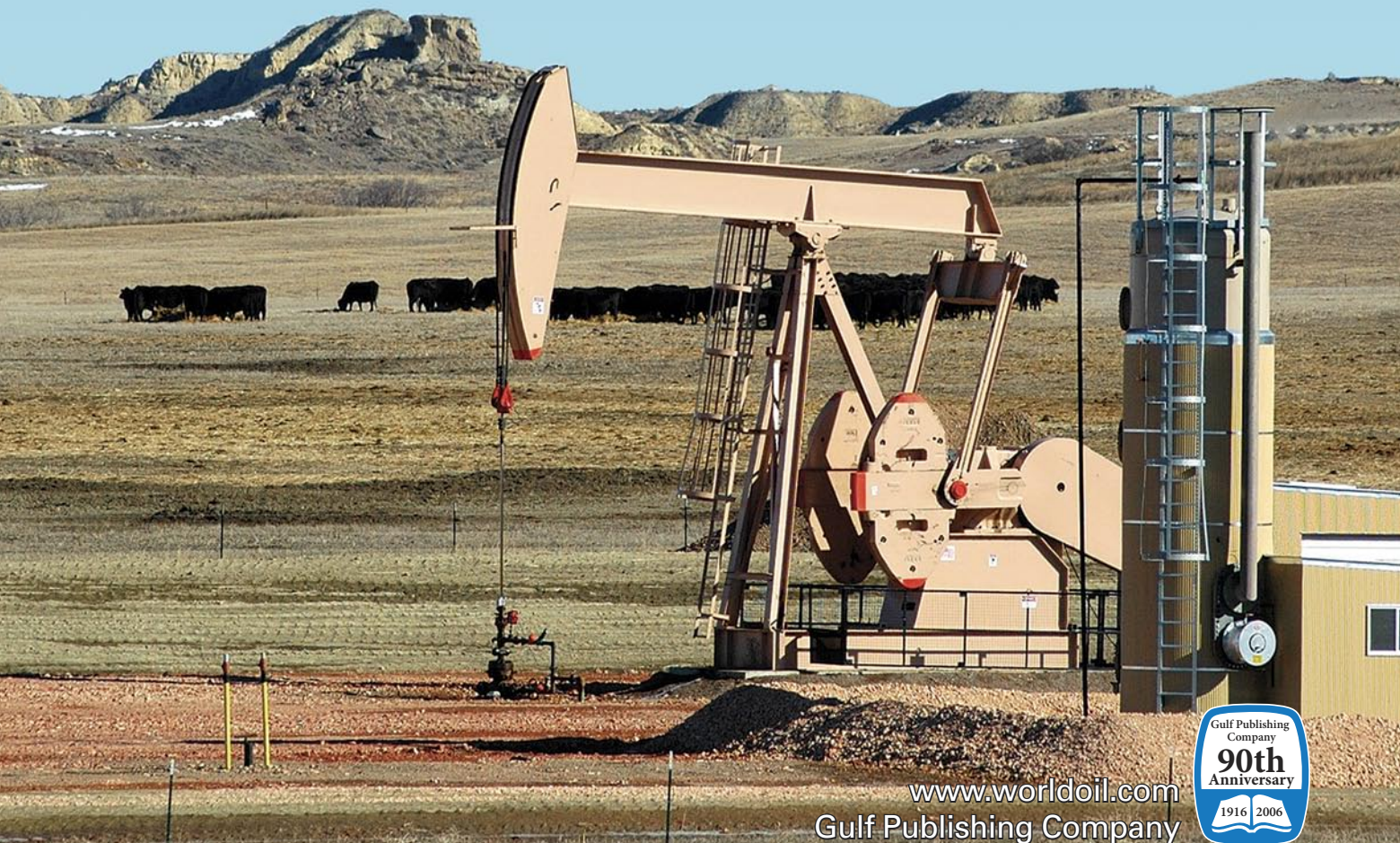
# World Oil<sup>®</sup>

Defining Technology for Exploration, Drilling and Production

November 2006

Excerpted from *World Oil*

**BIT TECHNOLOGY KEEPS PACE  
WITH OPERATOR ACTIVITY, pg 80.**



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Gulf Publishing Company



Excerpted from:

**World Oil**November 2006 issue, pg 80.  
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# Bit technology keeps pace with operator activity

**As operator preference shifts toward fixed cutter bits, manufacturers have rushed to develop new products to fill ever-expanding needs. Specialized roller cone designs still occur to fill niche applications.**

The following is an excerpt from the above article:

**Particle Impact Drilling.** The patented Particle Impact Drilling (PID) technology is a mobile system that readily adapts to typical conventional drilling rigs. This system is not intended to drill entire wells from top to bottom. Rather, it is designed to drill sections that are very difficult, time-consuming and costly. Intended intervals are very hard and/or abrasive formations.

The system will be provided and operated by Particle Drilling Technologies, Inc. (PDTI), as a service to oil and gas companies for drilling certain rock intervals; specifically in wells where penetration rates decrease, due to extreme compressive strength of the formations being drilled. Tests have shown that the PID system is capable of drilling through rock formations at rates multiple times faster than current conventional techniques.

The system relies on readily available hydraulic energy combined with round hardened steel particles entrained in the drilling fluid to rapidly excavate the rock formation being drilled. Unlike conventional drilling techniques, the process does not rely on weight-on-bit and torque to mechanically break the rock. Steel particles are introduced into the drilling fluid at a point downstream from the rig pumps, thus not interfering with the normal operation of the rig pumps.

These particles then flow down the drill stem and are accelerated through the nozzles of a specially designed fixed-cutter bit, striking the formation at more than 4 million times per minute and velocities of ~ 500 ft/sec. Particles and cuttings are circulated to the surface by the drilling fluid, where a shot-extraction device captures the particles for re-injection. The volume

of particles required is relatively small at only 2–3% of total fluid volume.

The PID application reportedly results in significant rate-of-penetration gains, thereby reducing the amount of time the operator spends on location to drill. Value is generated by savings in labor, fuel, rentals, rig time and other variable well costs, which should result in much more cost-effective drilling.

An initial field trial was completed by PDTI in the US, in Utah, and it verified penetration rates. Pump pressure events and the PID shot trap limited that trial's duration, so the shot recovery system was completely redesigned and successfully implemented on a follow-up trial. Continuation of field trial 2 was slated for late this year.

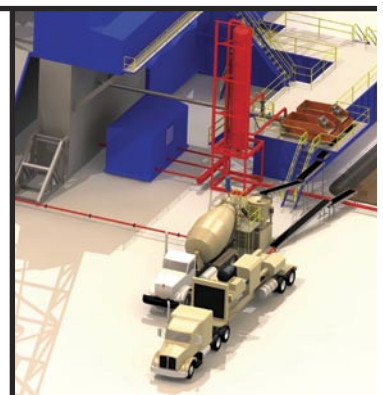
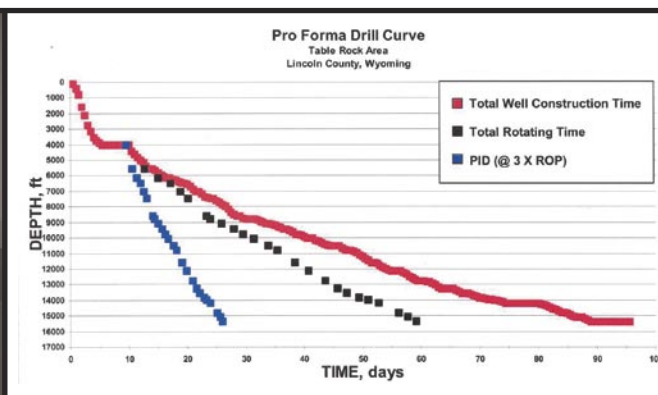
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The PID System bit features particle and fluid exit nozzles.



PID footprint on location.