



A Case History

Author and co-authors

J. Gregory Nutter	Xtreme Coil Drilling
Reg Layden	Xtreme Coil Drilling
Cody Grasmick	XTO Energy
Don Eubank	XTO Energy

Innovative Drilling Rig Delivers Increased Drilling Performance in Permian Basin

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IADC World Drilling 2009 Conference
June 17-18 in Dublin, Ireland

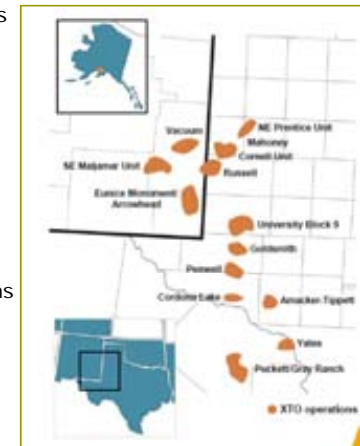
Introduction

Permian Basin Drilling Program

- ❑ Progression from roller cones to PDC
 - Applied PDC bits in lithology with compressive strengths greater than 30 Kpsi
 - Consistently using WOB parameters outside industry norms
 - Reduced production hole rotating hours from 25-50 percent compared to BEST roller cone performance
 - Heterogeneous nature of lithology requires near “foot by foot” manipulation of drilling parameters for PDC
- ❑ Improving PDCs with coiled tubing drilling rig
 - Achieved 20 percent reduction in rotating hours on second of four planned PNEU wells versus BEST PDC run
 - 40 percent reduction compared to average PDC run

Roller Cones → PDC

- ❑ Development drilling in 5 main fields
 - Goldsmith (Clearfork and San Andres)
 - PNEU (Clearfork)
 - CLCU (Devonian)
 - Mahoney (Clearfork and San Andres)
 - RCFU (Clearfork)
- ❑ Heterogeneous formations
 - changes in compressive strengths 5,000 -20,000 psi
- ❑ Historically drilled with “hard rock” roller cone bits
 - 3-type (5-4-7 IADC) to 4-type (6-2-7 IADC)



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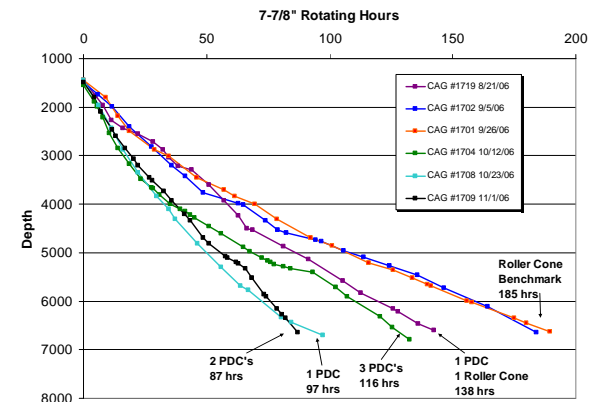
Ulterra Bit Progression – M1666DPB

M1666DPB E002

- ❑ Original design
 - 16 mm cutters
 - 6 blades, 6 nozzles
 - double row cutters
 - TCI load limiters
- ❑ 1st run on bottom 1,300 ft of CAG #1704 (10/20/06)



Goldsmith – Rotating Hours



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Ulterra Bit Progression – M1666DPB

M1666DPB E003

- ❑ Due to high WOB, several changes to E002 bit allowed for longer bit runs
 - shortened two inside cutters to add more matrix
 - added matrix webbing to center for durability
 - increased chamfer on cutters to 0.020 from 0.016



Ulterra Bit Progression – M1666DPB

M1666DPB E006

- ❑ Dull condition of second E003 bits prompted more durable design of E006 while maintaining P-rate
 - removed webbing
 - added one 16mm cutter in the cone
 - added two 16mm cutters on the nose and shoulder
- ❑ The addition of three full-sized cutters significantly decreased weight per cutter ratio



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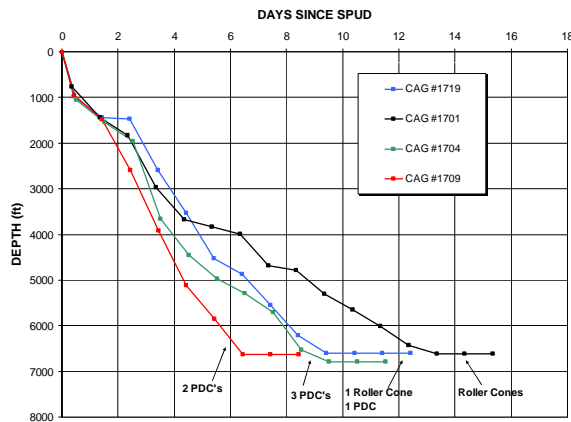
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Days / Depth - Goldsmith



Rotating Hours – Other Fields

Fields	AVG Rotating Hours (7-7/8" Bits)	
	Roller Cones	PDC
PNEU 7400 ft	156 hrs (HR30C)	90 hrs (2 ULT PDCs)
CLCU 5800 ft	175 hrs (HR30C, GX38C)	111 hrs (2 ULT PDCs, GX44C)
Mahoney (CF) 8200 ft	216 hrs (HR30C, F47HY)	140 hrs (1 ULT PDC, FH43Y)
RCFU 8750 ft	215 hrs (HR30C, GX38C, GX44C)	215 hrs (several combinations of PDC and roller cones)

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Coiled Tubing Drilling Rig



XTC 200 DTPlus



- Capable of drilling with drill pipe or coiled tubing
 - 10,000 ft of 3-1/2" coil
 - 8,200 ft of 4" drill pipe
- Comprised of two trailer mounted modules and five other main components
 - 1st module contains mast, top drive, rotary table, and injector unit
 - 2nd module contains coiled tubing storage reel
 - Other components include mud tank, two mud pumps, dog house, motor house, and hydraulic pipe tubs

Advantage of Coiled Tubing Drilling Rig

Capable of Drilling with DP or Coil

- Drill pipe
 - 4", 14#, Range III
 - top drive
 - ◇ 200,000 lbs hoist load
 - ◇ max torque – 23,000 ft-lbs
 - ◇ max speed – 200 RPM
- Coiled tubing
 - 10,000' of 3-1/2" (3.052" ID) tubing
 - ◇ tensile min - 184,400 lb
 - ◇ internal press - 9,700 psi
 - 200k A/C electric injector
 - ◇ 130" radius support strut
 - ◇ 110 ft/min tubing speed



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Advantage of Coiled Tubing Drilling Rig

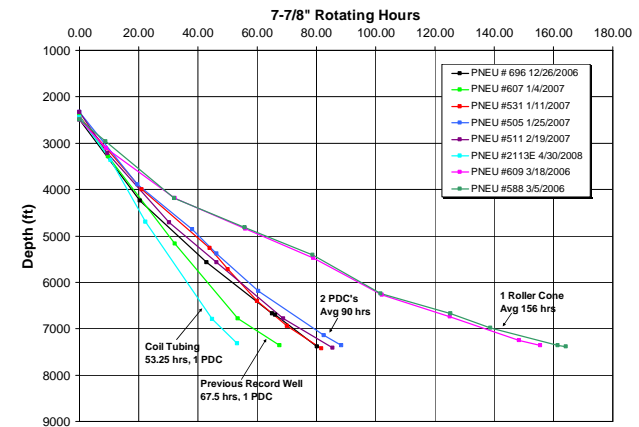
No Connections

- Continuous drilling with PDC on bottom (increases ROP and bit life)
 - eliminate potential for damaging bit when setting it back on bottom after a connection
 - PDC maintains a single bottom hole pattern
 - in 5000 feet, average of 160 connections
 - at 5 minutes per connection, coiled tubing saves approx 13 hours



PNEU #2113E (M1666BDP E006)
4890' at 91.4 ft per hr
Dull grade 1-3-WT-A-X-1N-NO-TD

Rotating Hours - PNEU



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Advantage of Coiled Tubing Drilling Rig

Faster Trip Time

- ❑ Coil can trip on average three times faster than drill pipe
- ❑ PNEU drilling
 - typically 1 bit trip and 1 TOH at TD
 - at TD of 7300' – TOH and LD BHA
 - ◇ coiled tubing rig (PNEU #2113E) - 3.75 hrs
 - ◇ conventional rig (average) – 6.0 hrs

Advantage of Coiled Tubing Drilling Rig

Rig Moves

- ❑ Total of 12 loads
- ❑ Each trailer (single drop 80 ton) features rear suspension comprised of 16 wheel quad axle
- ❑ Infield move time in PNEU
 - ❑ from arrival of trucks on location to spud
 - coiled tubing rig – 6 hrs
 - conventional rig – 12 hrs



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Conclusion

What we learned about PDC bits

- ❑ PDC bits are a step-change in Permian Basin drilling performance
 - but require additional attention and “out of norm” drilling parameters
- ❑ XTO is leading this initiative
 - other operators are observing and evaluating
- ❑ XTO percentage of PDC use has grown
 - from 0 percent in mid 2005 to 70 percent in late 2007
- ❑ PDC bit ROPs outpace best roller cones
 - 1.5 – 2 times faster
 - at equivalent or less total cost than inserts

Conclusion

What we learned about coiled tubing rigs

- ❑ Coiled tubing rig ROP
 - 3 times faster than best roller cone performance
 - 1.5 to 2 times faster than average PDC alone
 - depending upon depth
 - more potential left in next wells
- ❑ Coiled tubing rig saves time
 - no connection time
 - faster trip time
 - faster rig-up with fewer loads
- ❑ Better PDC dull conditions
 - reduced chance of damage while drilling off for connection
 - also in setting back on bottom after connection
 - reduced overall repair costs of dulls

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Conclusion

What we can learn in the future

- ❑ Full range of reasons for increase in ROP (motor, bit in better shape, less vibration, hydraulics, drilling with differential)?
- ❑ Will less damage to PDC with coiled tubing rig eliminate running second PDC to finish most holes?
- ❑ Will elimination of surge and swab during connections reduce lost circulation events and/or differential sticking events?
- ❑ Is differential pressure a better technique than WOB ?
- ❑ Will advantages of coiled tubing rig overcome those of conventional rigs to make coil the rig of choice in PDC drillable holes? What drilling problems will complicate coil rig use?
- ❑ Are coiled tubing rigs an option in other XTO areas such as horizontals or horizontal re-entry wells?

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Questions?

