

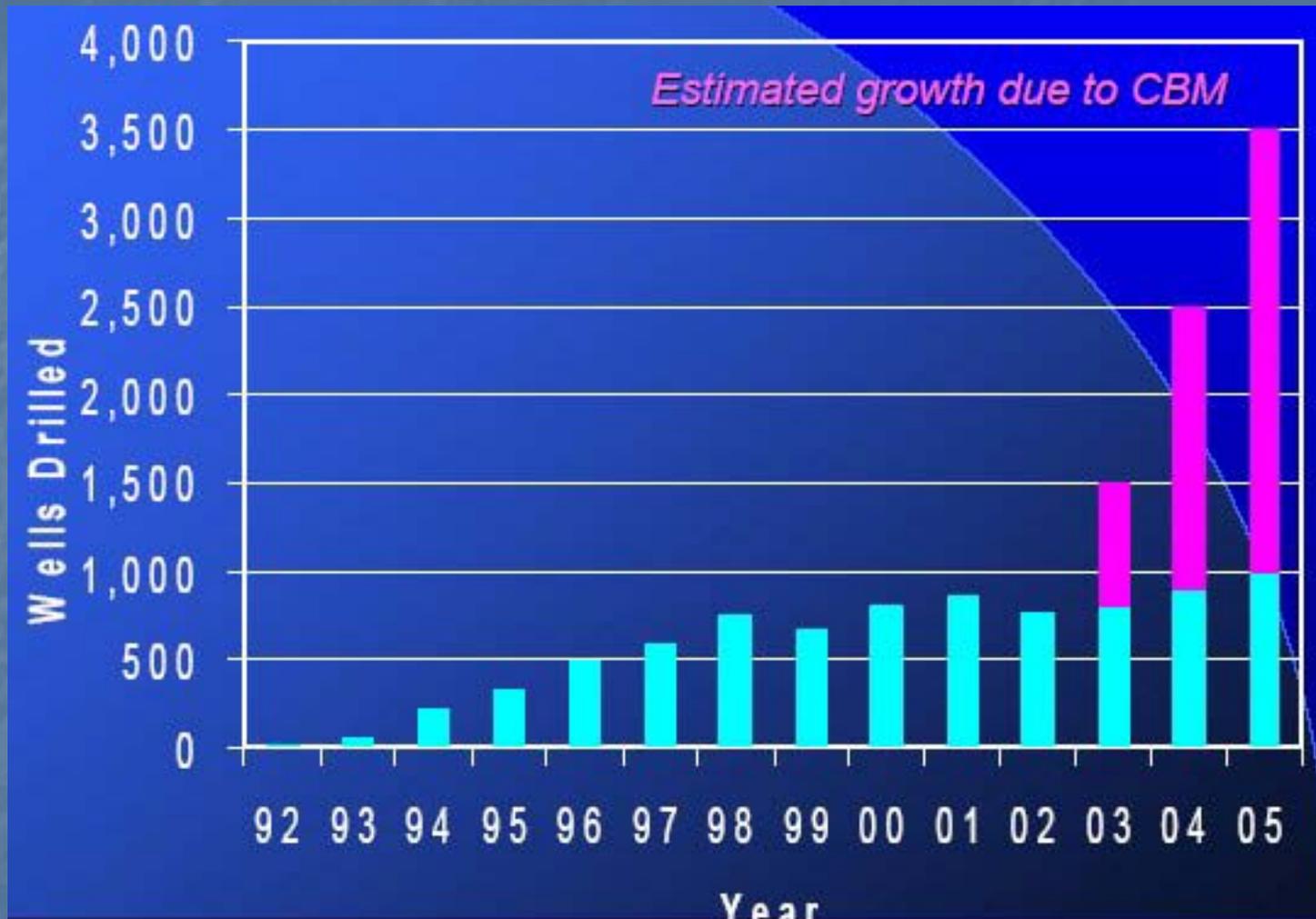


Coiled tubing drilling

A look at industry interest

Don Francis, Editor – E&P magazine – August 16, 2006

Wells drilled with CT*



*From a presentation by Joe Winkler, Chief Operating Officer, National Oilwell Varco, April 6, 2005

CT drilling acceptance in Canada

- Thousands of wells drilled annually (allowing continuous drilling, not one and off).
- Relatively soft, predictable sediments (infrequent sticking).
- Rigs designed precisely to fit 3,000 ft wells, experienced crews.
- Small to no footprint, wells close together reducing transit time.
- Fast move in and rig up time – 2 to 3 hours, fast penetration rates.
- All weather operations.

Obstacles to acceptance in the U.S.

- The tubing strength limits the depth (7,900 ft TVD is the record).
- Because it does not rotate, heterogeneous and unpredictable strata can cause it to stick – and fishing is very difficult.
- For a one and off well with a general service CT rig (as opposed to a built for purpose drilling rig), the rotary rigs, particularly the truck mounted air rigs, enjoy a cost advantage.

Obstacles to acceptance in the U.S.

- The ability to workover wells;
- Handling significant fluids in small boreholes;
- Limited space for downhole equipment;
- Lack of experience and familiarity with microhole and CT drilling;
- Depth limited by current coil metallurgy and coiled-tubing procedures; and
- Limitations of CT in overcoming drilling problems.

Technical advances in CT drilling continue. They may pave the way to greater CT drilling acceptance.

For example...

Hybrid CT rig



Hybrid CT rig

- Drill with either coiled tubing or conventional jointed tubulars.
- Highly efficient mobile drilling rig combines leading edge technology in coiled tubing deployment with the proven technology of conventional top drive drilling.
- Conversion from coil to conventional drilling is accomplished in the field without any measurable cost or downtime.
- Design is a collaboration between Foremost Industries and several other companies.

Hybrid CT rig

- With hook loads of up to 200,000 lbs at the top drive and up to 120,000 lbs at the injector, hybrid models can successfully drill to depths of:
 - 6,900 ft with 4 1/2-in. jointed pipe
 - 6,900 ft with 3 1/2-in. coiled tubing
 - 5,900 ft with 2 7/8-in. coiled tubing

Hybrid rig limitations*

- 4,500 ft depth limitation based on 3 ½-in. CTD to TD.
- 3 ½-in. CT marginal for 8 ½-in. surface hole drilling.
- 10,000 ft of 3 ½-in. CT too much for current hybrid rigs and difficult to move.
- Increases final hole size beyond needed 4 1/8 in.

*From a presentation by Michael Wheatall, Drilling Engineering and Operations Manager, Upstream Technology, ConocoPhillips, Inc.

Solution: casing/coil hybrid*

- Integrate casing drilling technology.
- Casing drill surface hole and intermediate hole.
 - Eliminates need for large diameter CT;
 - Casing drilling plus slim hole design greatly extends depth range for mast and pumps;
 - Retrievable BHA not needed for straight hole sections.
- 2 3/8-in. coil tubing to drill final 4 1/8-in. hole.
 - Extends rig capacity 10,000 ft depth.

*From a presentation by Michael Wheatall, Drilling Engineering and Operations Manager, Upstream Technology, ConocoPhillips, Inc.

Casing/coil hybrid advantages*

- Casing Drilling Benefits
 - Smaller rig, less fuel, reduced emissions;
 - Reduced trip time–Reduced trouble time (smear effect and no tripping);
 - No drill string –reduced hauling.
- Coiled Tubing Drilling Benefits
 - Faster drilling (no connections);
 - Reduced trip time–Managed Pressure Drilling/Underbalanced Drilling;
 - Facilitates use of oil based mud.

*From a presentation by Michael Wheatall, Drilling Engineering and Operations Manager, Upstream Technology, ConocoPhillips, Inc.

Casing/coil hybrid – conclusions*

- Cost reduction goal is achievable.
- Casing/Coil Hybrid drilling concept is feasible using current technology and available equipment.
- Other applications possible.

*From a presentation by Michael Wheatall, Drilling Engineering and Operations Manager, Upstream Technology, ConocoPhillips, Inc.

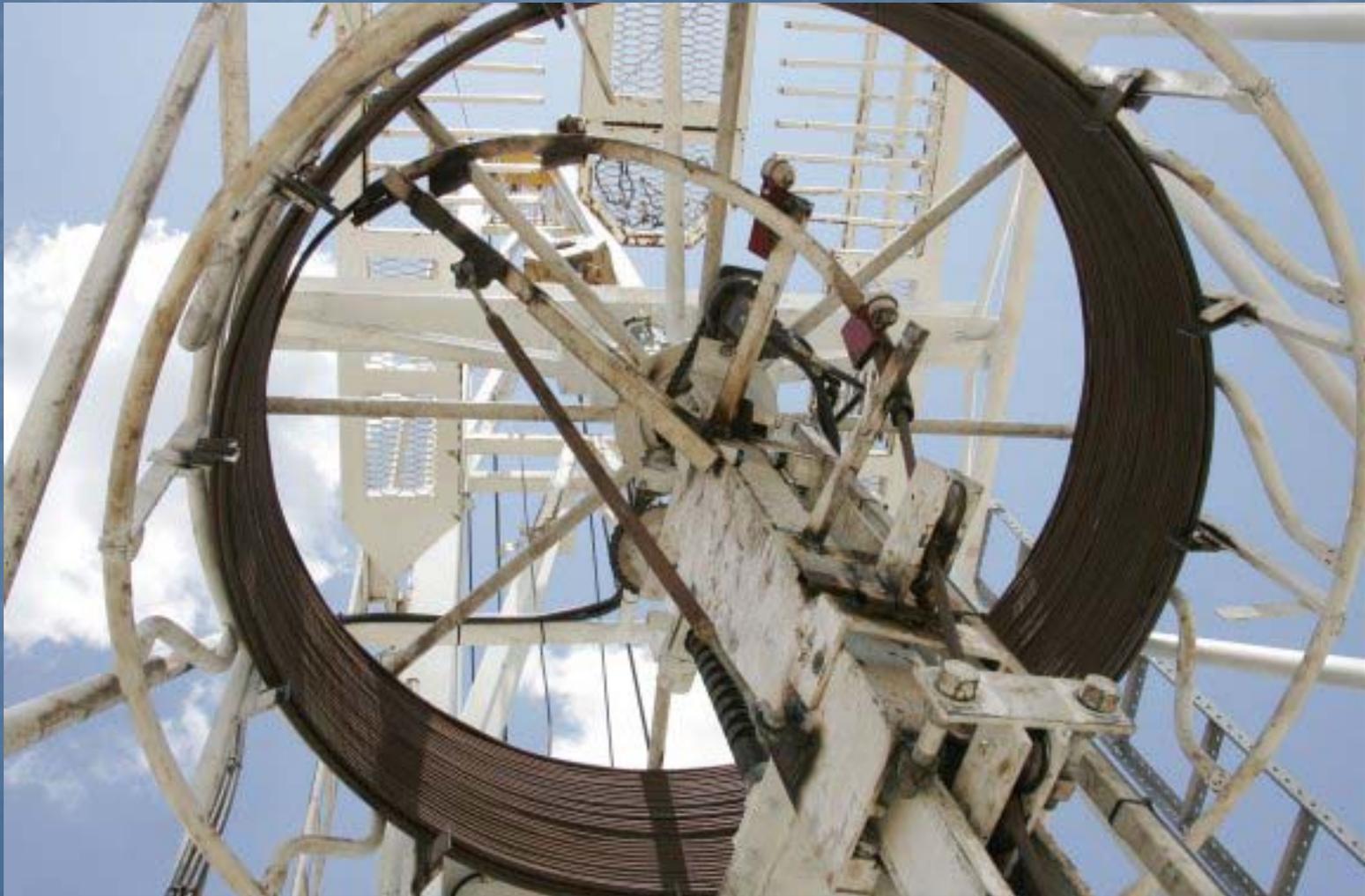
But a new concept may change
the game completely...

Rotating coiled tubing

Invented by John Van Way,
Rental and Fishing Tools, Inc.



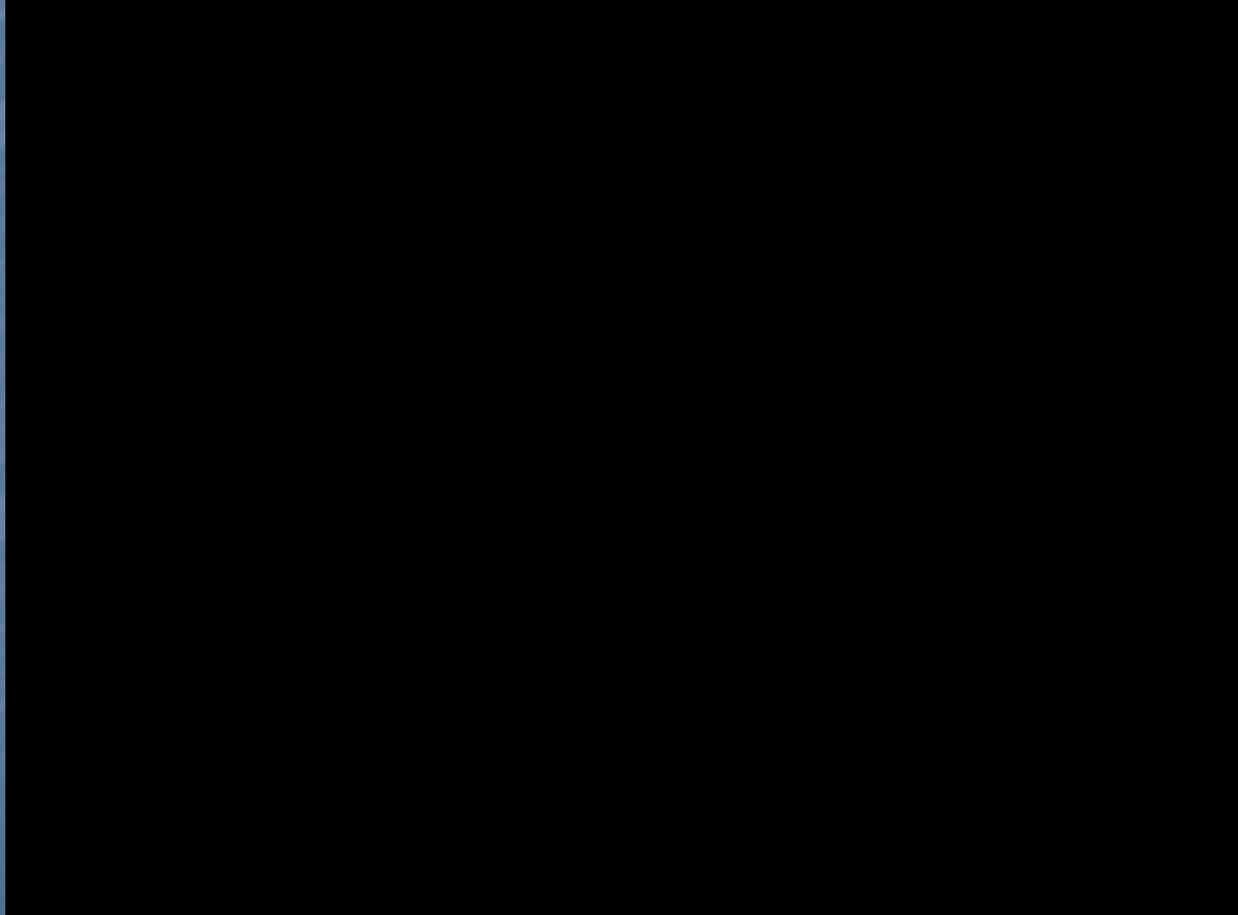
Rotating coiled tubing



Rotating coiled tubing

- Reduces friction in mud motor applications.
- Can be rotated or held still.
- Eliminates gooseneck injector bends – extends CT life by 5 to 7 times.
- Increases capability in lateral drilling.
- Many other operational and environmental benefits.

Rotating coiled tubing



CT drilling growth will also be driven by new seismic imaging technologies using microholes:

- Seismic attenuation and reservoir characterization.
- Time lapse seismic modeling and imaging of CO₂ saturation for sequestration and EOR.
- 4-D high-resolution seismic reflection monitoring of miscible CO₂ injected into carbonate reservoirs.
- Elastic wave field stratigraphy.
- New 3-D Vector Vertical Seismic Profile (VSP) imaging technology.

And finally...

"In fact, coiled tubing units are so compact and have such great potential, the Mars Drilling Project is evaluating, modifying, miniaturizing and fully automating a coiled tubing unit to drill for water on Mars.

Realistically, it will be years before the unit is developed and sent to by rocket to Mars, but it would be an important first step before Mars could be colonized. And coiled tubing technology will be greatly improved by the research."

-from the API web site



Thank you for your time today.