"Unconventional" technology aimed at cost savings

DRILLING AND COMPLETION advances in recent years—especially in high cost wells—have often resulted from finding ways to eliminate steps or conduct operations simultaneously. And in expensive multilateral wells, it is critical to optimize short term production and maximize total recovery.

Those time and cost pressures are behind the development of new techniques and equipment that are to be highlighted in the session, "Unconventional Technology," at the 2001 SPE/IADC Drilling Conference.

To be chaired by **John B Willis**, **Landmark Graphics** and **Mike Sheppard**, **Schlumberger Cambridge Research**, this session will include papers that deal with downhole flow control in multilateral wells, a heat seeking laser, a continuous welded tubing technique, casing drilling and slim hole operations.

FLOW CONTROL

Early production can have a significant impact on the economics of any well.

In paper 67728, "Downhole Flow Control Optimization in the World's First Extended Reach Multilateral Well at Wytch Farm," **H Gai** and **T L Malcolm**, **BP**, describe how the world's first downhole flow control device in an extended reach multilateral well is being used to optimize short term production and maximize reserves.

Design of an analytical optimization methodology and its application as well as operational data are presented in this paper prepared for the Drilling Conference together with lessons learned.

Installation of the downhole flow control devices made it possible to control the laterals independently, according to the authors. However, it is the operation of the devices that made it possible to achieve the objectives set out at the design phase.

The devices have now been operated reliably and satisfactorily since installation in February 1999, realizing the value of the completion system by delivering all the required functionality.

Additional benefits have been gained from the devices for regulating when the plant is water constrained or the well is ESP constrained.

"Unconventional" drilling techniques that can cut costs include this casing drilling job.

The authors cite these key observations and conclusions.

The downhole flow control devices have achieved all the designed technical objectives including: independently controlling flow from each bore; choking back flow or shutting off water; managing the draw-down level to protect a barefoot window; measuring the contributions of the two bores independently and eliminating data acquisition costs.

The optimization strategy developed is shown to work well and will be critical when the water cuts of the two laterals become closer.

For finer tuning of the model more data will be needed over longer term to realize the full potential of the completion system.

Operational priorities may occasionally override the testing program, but overall do not compromise the value of the optimization strategy. The authors note that the methodology can be applied in multilateral wells or multi-zone flow controlled wells to optimize the inflow performance of each lateral or zone and control water production from each.

The analytical modeling of individual wellbores or zones with different pressures and inflow characteristics has revealed the interaction relationship among the laterals or zones and provided the valve position selection criteria to operate the downhole flow control devices for overall optimal oil production.

The technique has demonstrated the value of its application through optimization of short term production and reserves.

It also, according to the authors, provided the industry with an efficient way of managing multilateral wells or multizone controlled wells.

CONTINUOUS WELD TUBING

A new concept has been developed where a complete production string, including sub assemblies, can be premanufactured on site, tested and subsequently installed into the well once the well becomes available. Construction on site removes the operation from the critical path and also overcomes the transport weight limitations associated with long and/or large diameter coiled tubing reels.

In paper 67730, "Continuous Welded Tubing: A New Concept in Well Construction," the authors describe the concept and its advantages.

The paper was prepared for the Drilling Conference by **T Harrison** and **M Keijser**, **Well Engineering Partners**; **E Koster**, **BJ Services International**; **K Koch**, **Airborne Development**; and **P Fokker**, **Nedmag Industries**.

The concept applies to tubulars up to 7-in. body OD. The tubulars are orbitally welded and spooled into a free-standing spiral using a standard industrial bending machine. Plastic deformation is kept at 1.5% or less, smaller than with coiled tubing strings.

During installation of the string a straightener is used in combination with conventional coiled tubing or snubbing equipment. For Big Loop manufacture, pipe is chosen using civil engineering standards, which define the chemical composition and ovality tolerances better than API standards, according to the authors.

The composition is critical to the welding process. In addition, there is often a greater range of sizes in civil engineering pipe when compared to API pipe sizes, which can give greater flexibility when optimizing production (e g velocity strings).

The installation of a continuous string into a well reduces or eliminates threaded connections thereby minimizing the potential for leaks.

Like coiled tubing, Big Loop can be installed in live wells using standard equipment, and the insertion or retrieval is generally faster than with jointed pipe.

The authors report that to date, two strings have been successfully installed.

Further developments are aimed at corrosion resistant alloys, cladded pipe and continuous pumping capabilities during insertion.

CASING DRILLING RETURNS

Casing drilling is emerging as a viable drilling technology for the 21st century although the concept has been around for decades and traces its roots to drilling liners to bottom in troublesome holes.

With the advent of dependable top drive systems, wireline retrievable bottom hole assemblies, PDC bits, and high torque connections, it is now possible to simultaneously drill and case a complete well using casing as the drill string.

Casing drilling shoe and bit is a key to BP Amoco's Wyoming casing drilling success.

The equipment and procedures that make casing drilling possible are described in paper 67731, prepared for the Drilling Conference by **R H Reiley**, **T M Warren** and **S F Shepard**, **BP**. "Casing Drilling: An Emerging Technology" also presents the results of a five well field pilot project.

BP Amoco is using the casing drilling process in Wyoming to drill both the surface and production casing intervals for five gas wells ranging in depth from 9,000 to 10,000 ft. The authors discuss the following critical issues that were overcome during the project:

- Well control while drilling underbalanced in the reservoir;
- Elevated equivalent circulating density due to restricted annular clearance;
- Stuck pipe prevention and drilling mud losses;
- PDC casing shoe and pilot bit design;
- Control of casing wear while rotating in abrasive formations.

SLIM HOLE POTENTIAL?

In the early and mid 1990s, one much discussed route to minimize drilling costs was to drill slim hole wells. But interest in the approach now seems to have waned.

In alternate paper 67732, "Slim Hole Saga," **D C Dupuis**, **Pride Forasol** focuses on the technology and its potential. The author reports that assessments were made of the geological data acquisition means in hole diameters ranging from 4¾ in. to 3⅜ in. Also studied were the production limits with wells having overall diameters of 4¾ in.

In gearing up for expanded slim hole activity, the author notes that drilling contractors designed and built dedicated equipment. Drilling programs took place and the economic results were encouraging. A global drilling decrease ranging from 30% to 50% was demonstrated, according to the author.

Then, he reports, after a few years slim hole drilling seems to have been forgotten. The author outlines what has been achieved and analyzes the reasons for the complete lack of interest—are they economic, technical, or psychological barriers?!