

Final Microhole Integration Meeting Minutes

August 16, 2006
Houston Research Center
11611 West Little York Road
Houston, Texas 77041

The Final Microhole Integration Meeting was held in Houston on Wednesday, August 16, 2006. Sixty-six people from all segments of the industry pre-registered. Actual attendance was 54. This meeting, the final in the series of integration meetings, was designed to provide a forum for the principal investigators of the projects in, and related to, the DOE Microhole Technology Program to present project accomplishments, milestones and remaining tasks to interested industry parties and researchers in related areas. The secondary goal is to highlight industry activity that is applying this and related technology in the field, with the goal to align the research goals with the needs in the field and bring to commercial application and industry adoption the technologies developed in the program. The morning coffee, breaks, lunch and post-meeting period provided opportunity for individual discussions. All presentations made at the meeting, as well as the previous three meetings, are posted on the PTTC Microhole website http://www.microtech.thepttc.org/past_meetings.htm.

The meeting began with registration, coffee and networking from 8:00 to 8:30. Don Dutlinger, Executive Director of the Petroleum Technology Transfer Council called the meeting to order, discussed safety and logistics, and then introduced Roy Long, DOE Technology Manager for the National Energy Technology Laboratory. Long discussed the status of the FY07 Oil and Gas program budget that was essentially eliminated from the budget prepared in the House Energy Appropriations subcommittee and that they expected to be on continuing resolution through the end of the year. As a consequence of that DOE will no longer be able to fund the quarterly MHT integration meetings. For the most part, ongoing projects will have funds for completion and PTTC, for the near term, will continue to keep the MHT website current and post project results as they become available.

The remainder of the morning session and two speakers after lunch consisted of Principal Investigators providing updates and milestones for the nine MHT ongoing projects that were not covered in the March 2006 meeting.

- Gas Technology Institute/Dennis Tools (Counter-Rotating Tandem Motor Drilling System, Kent Perry, PI; Eric Twardowski presenting): This project is an outgrowth of a smaller version of the system developed for Los Alamos National Lab and tested at RMOTC to 800 feet. The system is effective as the right hand reamer with PDC inserts relieves some of the rock's compressive strength and enables the use of higher torque and achieves drilling rates 2 to 8 times faster. The version being fabricated will have a 2 ¾ inch reamer turning 200 RPM and a left hand turning pilot at 1,000 RPM for a net 800 RPM. To date the pilot is

completed and the reamer under way. An August 30th test is planned at the Catoosa facility.

- Baker Hughes Inteq (Microhole Smart Steering and MWD System, John Macpherson): This project was designed to take a commercial bottom hole assembly, the Inteq Coil Trak and downsize it to smaller diameter. Both the resistivity subassembly and the rib steering motor have been fabricated and recently tested by BP on the North Slope. The planned test was to drill a 3-inch leg 1,700 feet out of a 4 ½-inch liner. 2,409 feet was achieved. After more testing, this tool will be commercialized in 2007.

- Baker Hughes Inteq (Microhole Wireless Steering While Drilling System, John Macpherson): This project to build a bi-directional power and communication module is designed to eliminate the need for an e-line to communicate with the steering system. It utilizes a 6 – 12 bits/second mud pulse with standard receiving equipment up-hole. The equipment is beginning the manufacturing phase and should be in test the first quarter of 2007.

- Stolar Research (Development of Radar Navigation and Radio Data Transmission for Microhole Coiled Tubing Bottom Hole Assemblies): Early versions of this technology were developed for the coal industry and now adapted to oil and gas. This assembly propagates low- and medium-frequency radio waves and can look at least 40 feet up and down. Data transmission is through the drill pipe or e-line if drilled with coiled tubing. A new algorithm is utilized to eliminate the near wellbore "clutter" to detect distant changes in rock properties. The prototype is being refined and fabrication is ongoing. Partners in the project are Consol and Encana.

- Impact Technologies, LLC (Advanced Mud System for Microhole Coiled Tubing Drilling and Advanced Ultra-high Speed Motor for Drilling, Ken Oglesby): Impact is engaged in the two listed projects, plus several others spawned by these Microhole projects, including "ASJ Microhole Drilling System" (Stripper Well Consortium), "Low Speed Motor for Drilling" (OCAST) and "SPI Gel Technology" (SWC/OCAST). The mud project will deliver a prototype zero-discharge mud-processing system and the design of an abrasive slurry jet-cutting nozzle and a high pressure slurry piston pump. It is scheduled to finish in early 2007. The second microhole project will deliver a design for a patented inverted electric motor capable of drilling up to 10,000 RPM in 1.69- and 3-inch versions. This project will be complete next quarter.

- Tempres Technologies, Inc. (Small Mechanically Assisted High-pressure Waterjet, Ken Theimer presenting, Jack Kolle, PI): This project advances a technology currently used to remove scale. It utilizes a split stream of gas and fluid. The gas and some of the fluid, 2/3 of the flow, is used to power the intensifier which develops a liquid stream of 10,000 psi and is applied through 8 jets in the 3 5/8-inch rotating drilling head. It is undergoing bench testing and has cut through concrete test samples. After additional bench tests, it will be tested in

the field. It is envisioned to be a commercial product with applications in under-balanced vertical and directional holes as well as scale removal.

- Ultima Labs (Microhole Coiled Tubing Bottomhole Assemblies, Don Macune): The objective of this project is to develop the main instrumentation subassembly and instrumented bit subassembly more suited to shallower, lower pressure and temperature wells likely drilled as microholes, hence less expensive than today's 3 1/8-inch tools (which reside for the most part only in Alaska). The main instrument sub consists of two sections – probe-based directional sensors, batteries, and mud pulser, and collar-based propagation resistivity. The near bit subassembly gathers information such as inclination, gamma ray, weight on bit, torque, pressure, and shock, and transmits the data to the main instrument sub above the mud motor via a half-duplex wireless communications link. It is 36 inches long. If a shorter version is required for short radius turns, it can be shortened 9 inches by removing the Gamma Ray and 2/3 of the batteries. Two prototypes will be ready for field testing in the second quarter of 2007.

- Western Well Tool (Microhole Downhole Drilling Tractor, Bruce Moore): The objective of this project is to produce a downsized version of the tractor Western provided to set the coiled tubing well intervention record of 30,000 feet at Sakalin Island. This will be the 5th generation of this technology. The prototype is 23 feet long with a gripper 3 3/8 inch, expanding to 4.2 inches. At 84 gallons per minute circulation, it can move 40 – 50 feet/hour and pull 3,500 – 5,000 pounds. It has been fatigue tested to 115,000 cycles, the equivalent of 59 miles travel. It will be tested in Alaska this winter and has spawned an internal project for a high expansion gripper, up to 8 1/2 inches.

- Kalsi Engineering Inc. (Advanced Sealed Bearing Assembly for Positive Displacement Motors used in Microhole Drilling, M. S. Kalsi): Kalsi Engineering has just been awarded a Phase II Small Business Innovation grant to manufacture and test the advanced hydrodynamic rotary seal and load responsive thrust bearings designed under Phase I. They will be suitable for use in most of today's positive displacement motors (PDM) used in coiled tubing drilling. The seal utilizes film to cause the moving surface to hydroplane over the fixed surface. The seals and bearings will be able to withstand high pressure and vibration and have a long service time.

The latter part of the afternoon session was kicked off by Dwight Rychel, who introduced the first industry speaker.

Robert Odenthal, Sr. Drilling Engineer for BP disclosed the plans and results of BP's 10 well re-entry program in the Cleveland formation of Lipscomb County Texas in the fall of 2005. This was BP's first try to export the coiled tubing re-entry technology currently applied in Alaska and Sharjah to the lower 48. The target was the Cleveland formation in Lipscomb County, Texas where BP operates hundreds of wells producing from a

formation 25 to 80 feet thick at a depth of 6,500 to 8,200 feet. The field was discovered in the 1950s with the original pressure at 2,100 to 3,300 PSI, now down to 1,200 to 2,000 PSI. The plan was to drill out of the 4 ½-inch casing with a 3 ¾-inch bit on 2 3/8-in coiled tubing, turn in a short radius and drill 1,500 feet horizontal. Ultimately, only 3 wells were completed due primarily to hole stability issues from a shale zone just above the pay zone. But the program showed a pattern of continuous improvement in time spent drilling and moving. The three completed wells came in at 40%, 55% and 130% of baseline results from grass-roots vertical wells and while the cost was 50% over budget, it was still 25% less than a comparable grass-roots program. After the first well, the non-productive time of the rig was only 14%. The results were sufficiently encouraging for BP to form a permanent organization and assemble the equipment for an ongoing program of re-entries in the area. Areas of potential improvement being investigated include mechanical or other zone isolation solutions, improved or different drilling rig and potential areas of savings.

The final speaker was Don Francis, Drilling Editor for Hart's E & P, who gave his view of the industry acceptance of coiled tubing drilling (CTD) in general and microhole in particular. Francis reviewed the explosive growth of CTD activity, primarily in Canada and how it is driven primarily by coalbed methane development as well as some of the reasons this technology advanced first in Alberta. Several emerging CTD technologies were discussed. ConocoPhillips has presented a concept to merge casing drilling with CTD using a single hybrid rig in order to reduce exploratory drilling costs by 50%. Another technology in concept stage utilized coil in a horizontal reel being rotated as it fed into the injector, which would reduce friction and flex the coil only once instead of the three times going over a conventional gooseneck before entering the injector. Sequestration will drive application of microhole for "designer seismic" using permanent, low cost receivers for long term monitoring. Francis closed with a news release from API indicating plans to use CTD on the planet Mars at some time in the future.

After the formal presentations Brian Dotson of BP indicated a need for an inexpensive way to deliquify 5,000 wells through 2 7/8-in tubing. The meeting concluded with a wrap-up led by Roy Long, again encouraging the participants to provide input to the PTTC MHT site so that all can keep current on the progress of the projects. The meeting was adjourned at 3:30.