Transferring Technology, Region-To-Region

One emphasis for PTTC is to share with independents across the country those technologies that are having good success in other areas. It is all too easy for us to stay with what is comfortable, with what is common in our part of the country. But for many technologies, there is a commonality that makes them applicable in many geographic areas.

PTTC initiatives that stimulate region-to-region technology transfer are: (1) leveraging insights from the "Produced Water Manual" developed within the Midcontinent region in PTTC’s DOE-supported PUMP project, (2) coordinating presentations from several regions for major regional society meeting, and (3) PTTC’s DOE-supported PUMP project.

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PTTC is a national not-for-profit information network formed in 1993 by oil and natural gas producers. Programs are funded primarily by the US Department of Energy’s (DOE) Office of Fossil Energy through the National Petroleum Technology Office (NPTO) and Strategic Center for Natural Gas (SCNG) within the National Energy Technology Lab (NETL). Other funding comes from state governments, universities, state geological surveys, and industry contributions.

Perspectives From The Chairman

James Bruning, Bruning Resources, LLC, Fort Smith, Arkansas, took over as PTTC’s Chairman in March 2003. His leadership culminates years of faithful service in both the South Midcontinent Region and on the National Board of Directors. With Jim now embarking on his tenure as leader, PTTC posed some questions to him about independents and technology.

It is helpful to first understand his background. Prior to forming Bruning Resources, LLC, Jim served as president and CEO of Freedom Energy, Inc., in Fort Smith, AR, from 1992 until 2000, when he sold his interest. A Ph.D. geologist with degrees from the University of Toledo and New Mexico Tech, he started in the oil and gas industry with Arco. Dr. Bruning has worked in Arkansas since 1977, with previous positions with TXO Production Corporation and Sonat. The governor of Arkansas appointed Dr. Bruning to the Interstate Oil and Gas Compact Commission (IOGCC). He is active in several professional societies and involved in IPAA.

Jim well recognizes the cost and time pressures that independents face, so PTTC will continue emphasizing delivering technology in a manner that respects these constraints. To that end, lunch and learn meetings have been one avenue that PTTC has been exploring.

Providing meetings in the local environment convenient to producers is another part of that equation. Jim believes, as do most independents, that face-to-face contact is still of great value.

When asked what the primary barriers to independents applying newer technologies are, Jim’s response was straightforward - money and time. The magnitude of the cost is one aspect, but an equally important aspect is that independents are not completely convinced that newer technologies work and are cost effective, so they delay.

PTTC’s program addresses that confidence issue by providing reliable information.

The time issue must consider not only the time spent becoming aware of technology through PTTC and others, but also the additional significant time required to truly become knowledgeable in the technology. That often takes looking through professional society literature, talking to vendors and suppliers, getting opinions from independent experts, etc. Staffing may need to be beefed up. The extra time and money for this process can be significant. Busy independents may forgo spending this time and money, but the consequences can be ill-informed decisions that can unjustly discredit newer technologies or missed opportunities when appropriate technologies are not used.

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posting summaries on regional workshops online (www.pttc.org/solutions.htm).

Building on experience gained from multiple "Produced Water" workshops in Oklahoma and Arkansas, six additional workshops have been scheduled in the Appalachian, Midwest and Texas regions (see regional websites for information). The base manual for these workshops is online at www.pttc.org/pwm/produced_water.htm. A producer’s panel session in the Michigan workshop will explore local application of those technologies.

PTTC recently participated in the joint meeting of SPE’s Western Region and AAPG’s Pacific Section, developing an "Independent’s Day’’ program for the Long Beach meeting. Speakers focused on technologies that were working, and what insights are generally applicable. Key insights are presented within the state-of-the-art summary of this issue (pages 8-9). In the coming months, PTTC will be making a significant contribution to the joint SPE/APPEX Eastern Section meeting in Pittsburgh (early September) and AAPG’s Midcontinent Section meeting in Tulsa (October).

Studying the rocks in West Texas to “Locate and Recover Remaining Hydrocarbons” during a May 29 workshop sponsored by PTTC’s Texas Region, the Bureau of Economic Geology, and University Lands West Texas Operations. Material focused on reservoir characterization issues in Ellenburger and Clear Fork reservoirs and also included the results of recent studies of unconventional gas resources in the Yates formation.
Environmental Corner

Nitrogen Vs Compressed Air in Coiled Tubing Operations, An Affordable Safety Practice?

Compressed air is most often used with coiled tubing operations. Well depth and whether there are likely to be liquid hydrocarbons in the well are key factors in determining whether compressed air is safe, or if there is a likelihood of a downhole explosion/ignition. One service company goes so far as telling employees not to use compressed air if there will be liquid hydrocarbons in the well. And there’s usually no liquid hydrocarbons in shallower low-pressure gas wells. Go deeper, below 2,500 ft, and there may well be liquid hydrocarbons with rich gas. One service company noted that industry has been experiencing more minute downhole “flashovers” in recent years with the introduction of higher-pressure air compressors. Risks are increasing with greater air-gas ratios. Consensus on maximum bottomhole pressure for safe usage of compressed air is needed.

Cost is most often cited as a major disadvantage of using nitrogen. But higher cost is partially offset by nitrogen’s higher lifting ability, and the higher volumes achievable with nitrogen pumps, more than double compressed air, can be a factor favoring nitrogen. To reduce cost, nitrogen vendors are working on pumper design. To increase their efficiency, non-fired heat recovery systems (from truck exhaust and coolant systems) are being employed to reduce or eliminate burners. Beyond efficiency gains, pumper units with non-fired heat recovery systems are more environmentally friendly. In the end, the nitrogen versus compressed air decision must balance cost and safety considerations.

Philosophically, companies are reacting positively to using more nitrogen at reasonable prices while providing more safety.

Excerpted from article in Drilling Contractor, March/April 2003, p. 4.

Health, Safety & Environmental Planning Guidelines for Underbalanced Operations

The Health, Safety and Training Subcommittee of IADC’s (International Association of Drilling Contractors) Underbalanced Operations Committee recently completed a draft document of HSE Planning guidelines. The draft guidelines are intended for use by integrated project teams involved in underbalanced drilling operations. The guidelines, which are applicable both onshore and offshore, provide information and guidance on HSE-related activities during the planning phase that will have an impact on safety during the execution stage. Not intended to replace existing company safety policies, the guidelines should be considered as a starting point for developing safety management plans.

Excerpted from an article in Drilling Contractor, March/April 2003, p. 24. The draft guidelines are available online through IADC’s website (www.iadc.org/committees/underbalanced/Draftdocuments.html).

Multi-Faceted Environmental Work at RMOTC

DOE’s Rocky Mountain Oilfield Testing Center (RMOTC) in Casper implements projects with a definite environmental flair, in addition to projects that field test technologies. Four such projects, each outlined in their recent newsletter (www.rmotc.com/Today/Newsletter.html), are summarized below.

Regional Carbon Sequestration Partnership, RMOTC is part of a newly formed Rocky Mountain Regional Consortium of academic, industrial, governmental and non-profit organizations that are investigating the capture, storage and overall reduction of greenhouse gases. Potential carbon sinks in the Rocky Mountain region are both geological and terrestrial. Potential geological sinks include nearly depleted oil and gas fields, saline aquifers and extensive unmineable coal seams. In the near term, sequestration of CO2 in terrestrial ecosystems, such as high altitude pine forests, offers a low-cost means of reducing net carbon emissions. For more information about the Consortium, contact Vicki Stamp, RMOTC (Vicki.Stamp@rmotc.doe.gov).

Wetlands-Treated Produced Water, RMOTC, Chevron Texaco and Clemson University are conducting a three-year project testing constructed wetlands-treated produced water for beneficial reuse. Both RMOTC and Clemson will construct pilot wetlands to remove hydrocarbons and salts from produced water. As water is released from the constructed wetlands, studies will be performed to identify the viability of using treated water in beneficial applications. Among other things, growth rates of vegetation in treated water will be compared with those using standard irrigation water. Workshops presenting results are planned. For more information, contact Lorri Jackson, RMOTC (lorri.Jackson@rmotc.doe.gov).

Ice Cleaning System for O&G Field Operations. The Ice Cleaning System, which converts water into small ice particles that are pressured through a hose-nozzle system to clean surfaces, is environmentally attractive since it generates a minimal amount of residual waste. Performance in an oilfield environment was documented in a RMOTC field test (www.rmotc.com/pdfs/IceCleanSystems.pdf). The demonstration confirmed that the equipment could be carried on board the tender vessel and buoy maintenance performed at sea. For more information on the various applications of the Ice Cleaning System, contact Lorri Jackson, RMOTC (lorri.Jackson@rmotc.doe.gov).

Dust Control in Powder River Basin CBM Operations. As part of a coalbed methane research program at RMOTC, staff members have identified dust from unpaved roads as possibly a significant impediment to planned developments in the Powder River Basin. They are working with other technical experts and county road engineers to develop Best Management Practices (BMPs) for constructing and maintaining unpaved rural roads within regulatory limits for airborne particulates. For more information about this and other aspects of the CBM program, contact Jim States, RMOTC (Jim.States@rmotc.doe.gov).

Drilling, Well Servicing Training at San Juan College, New Mexico

The U.S. Department of Labor (DOL) recently announced an award to San Juan College, Farmington, New Mexico, to support the development of an energy-based Business and Industrial Training Center. The $2.17 million grant will be used to fund petroleum technology training and placement programs to support industry needs in New Mexico and the adjacent Four Corners area. The programs will provide education, training and job-placement assistance involving non-traditional classroom for hands-on training on actual equipment, including a workover rig donated by Key Energy Services. The programs are expected to lead to 300 full-time jobs.

Technical training will be provided in industrial safety, drilling and well service, gas compression technician skills, plant operations, commercial driving skills and heavy equipment operation. It will also offer short-term fast track job training, one-year certification programs and employment assistance. This effort is part of the President's comprehensive plan to ensure that the nation has the energy - and the energy workers - it needs.

Excerpted from article in Drilling Contractor, March/April 2003, p. 4.
Servicing Continuous Rod Installations

Coiled rod applications, introduced to the market some 30 years ago, have been limited by the fact that two rigs are needed for servicing continuous rods—one to service the well and another to manipulate the coiled rod. Pro-Rod, a division of C-TECH Oilfield Technologies, Inc., has addressed this problem with their recently developed X-Celerator® tool.

The X-Celerator® tool is a coiled rod injector head with two motors that power gear-driven tracks. The tracks in turn drive chains with aluminum inserts that grip the coiled rod. The tool can be picked up and be ready to work within 15 - 20 minutes by any well service rig. This avoids the back-and-forth rigging up and rigging down that occurs when two rigs are needed for servicing wells with coiled rod. With the service problem addressed, coiled rod may see increased usage. The advantages of coiled rod are that it has no couplings, it reduces tubing wear and it requires less pumping horsepower.

Knowledge Management, What Has Industry Learned

In a recent article in Hart's E&P (June 2003 issue, p. 55-57), Tina Berger, Obsidian, defines knowledge management as “the set of processes through which employees share business-critical knowledge across an organization to increase profits and reduce problems for the company.” Considering industry's experience with early processes and the above definition, he lists 10 critical factors for successful knowledge management, presented in abbreviated form below:

1. Begin with a specific business issue related to the long-term profitability of the company
2. Determine in advance how you will measure success
3. Begin with an enthusiastic receptive group (not necessarily the whole company)
4. Integrate the change into existing business practices (how will it fit)
5. Use technologies as enablers, not drivers
6. Designate owners, find champions to keep the process visible and tools up to date
7. Provide communication and training, don't just expect people to jump into it
8. Pilot test with a small group and work the bugs out
9. Publicize successes
10. Provide incentives and awards

Regardless of company size, today's industry operates on the lean side with regard to staffing. Employees are frequently asked to jump into areas outside their expertise. Then there are the age demographics of the industry. Companies don't necessarily need to be large to have an incentive to implement a knowledge-management process.

Another article in that issue states what may seem obvious “people only go to people they trust for information.” This is why communities of practice and knowledge brokers have their role. The data that groups rely on must be equally trusted, so meta-data (that is, data about the data in any database) files must be comprehensive and current. It must also be recognized that knowledge goes beyond data and facts to include experience, values, context, insight and intuition.

Field Test Performance Positive for PSI’s Innovative Submersible Pump Design

Pumping Solutions, Inc.'s (PSI) innovative submersible pump, which uses a positive displacement hydraulic pumping mechanism, performed well in field tests at the Rocky Mountain Oilfield Testing Center (RMOTC). Data from the RMOTC field tests indicate that savings, compared to conventional oilfield lift systems, of as much as 50% in operating costs are possible.

The pump uses a one horsepower, three-phase, submersible electric motor that requires only an average of one kilowatt of power. The pump is fundamentally different from pumps currently on the market because it is located completely within the wellbore, and the casing is sealed, eliminating noise, emissions, and hazardous conditions. The pump, with its self-contained electric motor, is similar to an electric submersible centrifugal pump in appearance and installation characteristics. The pump design can handle volumes up to 400 bbl/day and depths up to 12,500 ft.

Some 20 tests conducted at RMOTC to date under a variety of conditions have generated performance data on power consumption, run time, and production volumes lifted. Pumps were installed on conventional tubing into Shannon formation wells. A few tests used the cable suspension system developed by PSI. The problems addressed and solved during the RMOTC tests were splicing techniques, diaphragm materials issues, corrosion, and general operating procedures. The RMOTC tests demonstrated that the pumps can be run safely on 2 3/8” tubing and on cable suspension without damaging equipment.

PSI has completed development of a 3 3/4” 30-300 bfpd, up to 4,500 ft. lift unit and is devel-
opining variations for other applications, including a 2” pump, a 4” deep set pump, and a 4.5” high flow version. PSI continues to receive support from DOE, industry, and the Stripper Well Consortium for future development.

Excerpted from information provided by Rocky Mountain Oilfield Testing Center. For more detail, contact Joe Rochelle, RMOTC (phone 307-261-5000 X5074 or e-mail joe.rochelle@rmotc.com) or Leland Traylor, PSI, phone 505-933-4653.♦

E&P Toolbox Offers Web Access To Industry Software

The Society of Petroleum Engineers (SPE) has partnered with Petris Technology, Inc. to provide online access to industry software through the E&P Toolbox. Customers can “rent” a software application for a time period meeting their requirements. This service allows users to access software that previously may have been out of reach financially, and they don’t have to hassle with keeping software that is used only intermittently updated. For those busy exploring for and producing oil and gas, the software maintenance aspect can be important.

The Toolbox contains more than 25 software packages in several areas, including among others: Reservoir Engineering and Simulation; Drilling Engineering; and Completion and Production Engineering.

Prices vary according to the package and are listed on the website. SPE members receive discounts on administrative costs. Visit SPE’s website (www.spe.org/EandPtoolbox/) for more information.♦

Online Handbook Updates Drilling Completion Data

An updated field handbook for cementing, stimulation and coiled tubing is available online through Schlumberger Oilfield Services. It features six sections: (1) General Information, (2) Coiled Tubing and Pipe Data, (3) Volume Data, (4) Fracturing-Related Data, (5) Cementing-Related Data, and (6) Acid, Oil and Brine Data.

There are calculators to help with multiple well operations such as drilling and workover, cementing, fracturing and general unit conversions. There is also a library of predefined wellbore diagrams, with copy and paste operations for exporting handbook data to software applications.

The t-handbook is available online at www.slb.com/oilfield/index.cfm?id=id1384022 at no cost.♦

Reducing Downhole Failures, Practices That Work

Pioneer Natural Resources USA Inc. (Pioneer) has openly shared their “best practices” for reducing downhole failures that have evolved through a multi-year focused effort in West Texas. Highlights of that effort bear repeating since, in some 3,200+ wells in the Spraberry trend, overall well failures have been reduced to a third of pre-program levels, or from about 1.05 failures/well/yr to about 0.35 failures/well/yr.

The tubing testing program evolved from hydrostatic testing on location to off-location electronic inspection to wellhead scanning.

With hydrostatic testing, 10 joints above and below the leak were replaced with new or yellow band (0-15% wall loss) tubing. For offsite electronic inspection, the bottom 100 joints of tubing were inspected and anything with greater than 30% wall loss (green or red band) was replaced. Note that initial electronic inspections replaced 40-50% of the tubing, while just a few joints needed to be replaced when strings were electronically inspected again at later dates. The bottom 100 joints are now scanned onsite.

There was a similar evolution in rod practices. Initially, rods from numerous manufacturers that were equivalent to Norris-54 grade-D rods were used. That has now evolved to using rods “from a single manufacturer equivalent to Norris-78 grade-D rods.” Rod string redesign included removing the bottom 450 feet of 7/8-in guided rods, controlling downstroke buckling by installing sinkerbars and balancing stress loading at the top of each rod taper. Sinkerbars had a very positive effect on tubing failure rates. Pump-off controllers, with or without sinkerbars, were also very efficient at lowering tubing failure rates.

Pioneer uses some internally plastic-coated (IPC) tubing. Their conclusion was that its best use is for problem wells. There are a number of wells evaluating poly-lined tubing. It has performed well and is considered a good alternative, although some reduction in inner tubing diameter is experienced.

These and many other successful practices are helping Pioneer reduce electrical consumption, reduce failures and realize a slight production increase. Keys to making it all work are commitment, an accomplished well

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analysis department, a team environment including vendors where all have appropriate responsibility and accountability, training and management commitment.

Excerpted from article in American Oil & Gas Reporter, June issue, p. 92-97.

Moisture Recovery Unit For Online Cleaning of Gas Turbines

Operators of gas turbines know that dirty turbine blades can account for two thirds of efficiency losses in gas turbines, so blade cleaning is a standard practice. But automated online cleaning through water washing has often not been successful because of problems experienced with delivery and control systems and maintaining water of sufficient quality (measured by conductivity). Most manufacturers recommend water conductivity of 3.3, which typical water systems provide.

The innovative Moisture Recovery Unit (MRU) developed by International Water Makers, Inc. captures water from the atmosphere. Suspended salts, dust and other gaseous contaminants are removed from air before capturing water from it. Captured water is passed through five stages of filtration. Water purity is such that conductivity is below 1.0, significantly above minimum specifications.

When this pure water is combined with an effective microprocessor-based control system in a packaged unit that allows automated online washing every 1 to 2 days, turbine blades can be kept clean and efficiencies maintained at 99%. Automated online cleaning reduces manual shutdowns, potentially to annual cleaning or longer. One large oil producer using the MRU system is sufficiently satisfied to term it a “best practice” for their onshore and offshore gas turbine cleaning applications.

Excerpted from article in Go Gulf magazine, March/April 2003, p. 46-47. For more information, contact Don Milliman, phone 800-450-3531, e-mail iwm36@yahoo.com.

Alternative Lift System for Stripper Wells, Selcon Co-Lift

Selcon Co-Lift, an alternative lift system that circulates an oleophilic (oil-attracting) band through the oil zone and back to the surface where the oil is squeezed out, targets low volume stripper wells producing minimal gas. It is designed for wells with static fluid level less than 3,000 ft. Minimum casing ID is 4 inches. The system is easily moved, so one unit can sequentially service several wells, giving oil time to flow into wellbores as other wells are serviced. Noise is minimal and low profile versions are available, further making the unit attractive.

When the circulating band is squeezed, oil drains into a collecting tray and out through a side pipe to a collecting tank. Since the band is oleophilic, water is not lifted, making operating costs very low. Band circulation speed can be controlled to optimize production. Field production tests have shown excellent results with heavy oil, but the system works for any gravity oil. Units have been operating in Argentina for several months, plus units are now under field test in the Luling, Texas area.

The system is available for sale, lease or production sharing agreements. For more information contact, sales@selconcolift.com or call 713-628-0536.

Deepwater Drilling: Where are We Headed?

On June 17-18 in Galveston, about 100 participants addressed this issue at a meeting sponsored by the Drilling Engineering Association (DEA). There was a notable increase in international participants compared to 2002. The two-day workshop focused on the separate systems areas of operations: tubulars, rigs and vessels on Day 1, followed by annular flow and wellbore stability on Day 2. Both days included breakout sessions where discussion dealt with closing technological gaps. Participants find the breakout sessions most rewarding due to the candid discussion about how industry can work together to advance technologies. This workshop is an example of how resources are being leveraged since DEA became affiliated with the International Association of Drilling Contractors (IADC) last year.

Participants expressed concern about identifying barriers to technology commercialization. Several early Joint Industry Projects (JIP) conducted within DEA proved that certain technologies worked, but there hasn’t been broad acceptance. An example of this might be dual gradient drilling—although proven by field testing, alternative solutions may delay investment in this solution.

Is it market issues? Technology push versus industry pull? Investment issues? Lack of awareness/knowledge on the producer’s part? The challenge is not just in drilling. Expanded tubulars, which are proving to have many applications onshore as well as offshore, would not have happened without the steadfast commitment of one major operator and one service company working jointly. Technology commercialization is a changing pursuit today.

For more information on the DEA and IADC, visit their websites at www.dea.main.com and www.iadc.org.

Photo courtesy of David Cothran
Network News
State-of-the-Art Summary

Affordable, Effective Technologies Being Applied by Independents
by Lance Cole

Two PTTC-developed sessions titled "Independent's Day" were presented at LA Basin 2003, a joint meeting of SPE’s Western Region and AAPG’s Pacific Section in Long Beach, California on May 22nd. They presented examples of technology applications that are working across the country to encourage participants to learn from experience across the U.S.

Dr. Iraj Ershaghi, PTTC’s West Coast Region Director, issued a challenge to independents to become familiar with and apply "smart well" technologies.

Major operators in large fields have employed smart well systems, and in doing so, they have reduced costs and improved recovery. Technology improvements are bringing the cost and complexity down. The goal is to change from episodic or reactive (after the fact) management to continual, real time, proactive management. This means monitoring parameters soon enough and frequently enough that early warning signs are seen so that changes can be made that prevent failures.

Mark Reedy, Global Energy Partners, presented key insights from a recent study about reducing power consumption in California’s old pumping oil wells. The study found that nearly 50% of the wells could benefit from optimization. For change to occur, old mindsets about continuing to operate "as is" versus investing for efficiency must be changed. Opportunities for power cost reduction fall into electrical or mechanical categories.

Key steps include examining motor efficiency, installing pump-off controllers, combating gas interference, monitoring performance and reducing water production. In California’s case, this study led to a rebate program that reimburses operators for some of the investment required to become more energy efficient.

Bob Kiker, PTTC Permian Basin, described how operators there are changing their wellbore management programs to reduce failures, by as much as a factor of 10. Supported by several case studies, operators have found that structured programs requiring all involved (operators and appropriate vendors) to work closely in teams with defined accountability can have dramatic results. Open sharing of preferred practices or "what's working" is quite common in the Permian Basin, which only aids these structured programs.

Modern reservoir simulation technology is user-friendly, PC-based, powerful (quick run times) and robust (can handle complex problems). This enables companies to get results quickly, resulting in more reservoirs being modeled and simulation results being used to aid in near real time decisions.

Jim Erdle, Computer Modelling Group, made the point that for even majors, the historical practice has been to only perform reservoir simulation in "core" assets. But that practice is changing. He noted how one engineer with a major had, in just one year, simulated 25% of the profit center's reservoirs. Over a two-year period, an estimated 7 million BOE of reserves were added. In another example, he noted how simulation helped an independent make a timely decision about the level of steam injection (cut back or discontinue completely) during California's energy crisis in the winter of 2000-2001. A proven simulation model was on hand, so the operator's consultant could quickly perform "what if" scenarios. The operator cut back steam injection, saving $6.7 million within just six months, and changes were made with the confidence that long-term adverse impacts had been minimized.

Old plays can have new life with new technologies. Rodney Reynolds, PTTC’s North Midcontinent Region Director, described how larger volume gel polymer treatments using MARCIT™ technology and GasGun™ solid propellant stimulation treatments are increasing production in Kansas’s very mature Arbuckle producing areas.

Reynolds noted that, since early 2001, more than 150 production wells had received large volume gel polymer treatments. Similarly, more than 50 operators had stimulated nearly 150 separate wells with GasGun™ treatments with about one-third of those being in the Arbuckle. Overall results with both technologies have been very positive. PTTC staff is working to further document case studies and periodic workshops keep producers aware of current activity and results.
New plays, like the Trenton-Black River in Appalachia, thrive on new information and data. Doug Patchen, PTTC’s Appalachian Region Director, has organized several workshops, drawing more than 600 attendees. Free flow of information and interplay among participants has favorably influenced the evolution of exploration, drilling and completion concepts. There is consensus on future R&D and technology needs and a multidisciplinary study involving several regional organizations and multiple industry partners has been proposed to DOE.

DOE’s oil and gas R&D program through the National Energy Technology Laboratory often plays a role in development and demonstration of technology as they would if the above Trenton-Black River proposal materializes. Providing evidence of the impact of DOE support, Gary Walker from NETL’s National Petroleum Technology Office in Tulsa shared case study examples from recent programs, primarily the Class program. As a point of interest, DOE was also involved in one way or another in the immediately following examples about through-casing resistivity logging (early R&D) and horizontal drilling in Michigan (key demonstration well).

Through-casing resistivity logging took a long time to develop, but once commercialized by Schlumberger with its Cased Hole Formation Resistivity (CHFR) log, usage has increased rapidly in California (more than 250 CHFR jobs). In the California geological environment with alternating zones of oil and water or zones where current oil saturations might be different than original, having current resistivity data is critical. In his presentation, Bill Heiam with Schlumberger also discussed other newer technologies that were working in the California environment.

Bill Harrison and Robb Gillespie, representing the Michigan satellite of PTTC’s Midwest Region, presented a timeline of Michigan horizontal activity. From the 1st horizontal well in 1982 through 1994, only 66 horizontal wells were drilled. Beginning in 1995 and at least partially fueled by a DOE-supported demonstration project, activity increased significantly and the reservoir targets/applications expanded. Activity, although fluctuating, has remained high and early 2003 data indicate that current levels are remaining very strong.

50% of Michigan horizontals have been for redevelopment in known oil and gas fields. Exploration and gas storage count for another 20% each. The Niagaran Reef is by far the most common target, representing 59% of horizontal wells. Other prominent reservoirs include the Antrim Shale and Michigan Stray Sandstone. Follow-up conversations with those attending PTTC horizontal drilling workshops (2001, 2002, 2003) indicate the presented technology insights and data resources of the Michigan Basin Core Research Laboratory have helped maintain the strong momentum.

Sada Joshi, Joshi Technologies, Inc., summarized overall experience with horizontal wells in the U.S. (SPE 82621). Through December 2002, there were about 17,300 horizontals with 43% of those being in the Austin Chalk, followed by the Red River formation in North Dakota. Overall, he outlined nine application environments. The majority of U.S. wells are in carbonate reservoirs, contrasted with international experience where use in clastic reservoirs is most common. His assessment is that the current commercial success rate for U.S. horizontals is 65%, although he did note that success rate generally improves as more wells are drilled in a given formation in a given area. Horizontal drilling costs might be 1.5 to 2.5 times higher than for vertical wells, but finding costs for many horizontal projects are 25% to 50% below costs of buying proved reserves. With higher productivity, operating costs on a $/bbl basis for horizontals can be half or less of that experienced by vertical wells.

Acknowledgement: PTTC acknowledges and greatly appreciates the support of the “Independent’s Day” presenters. Presentations of the afternoon speakers representing different PTTC regions can be viewed online (www.westcoastpttc.org/presentations/02-03/052203/afternoonindex.htm)
DOE Selects Six New “Independents” Projects

DOE’s “Technology Development with Independents” program works to assist small independents in testing higher-risk technologies. Since inception in 1995, 57 projects have been initiated. In this latest round of six awards (www.netl.doe.gov/publications/press/2003/1_independents051303.html), DOE is providing $580K of funding with participants providing an additional $728K of funding. Those winning awards and the field locations are in several states.

Arnell Oil Company (CO) will demonstrate alkaline-surfactant-polymer (ASP) chemical flooding in the Poison Spider field in Natrona County, Wyoming. This technology demonstration will expand chemical flooding applicability to higher viscosity reservoirs.

Bass Enterprises Production Company (TX) in coordination with the Bureau of Economic Geology at The University of Texas at Austin and Trend Technology, Midland, Texas will demonstrate how independent oil producers can acquire and analyze advanced imaging data from small seismic test patches embedded in large-scale seismic surveys.

Grand Mesa Operating Company (KS), in collaboration with TIORCO, Inc., Englewood, Colorado and the University of Kansas, Lawrence, Kansas, will demonstrate the feasibility of polymer gel technology to increase the recoverable reserves from Mississippian reservoirs in Kansas. If successful, the use of polymer gels will reduce water production, reduce well operating costs, and increase oil production throughout the region.

Peden Energy (TX) will demonstrate that micro-turbines are more efficient and less costly to operate than traditional internal combustion engines/generators. Additionally, Peden Energy will install variable frequency drives (VFD) with computerized pump-off controllers on two pump jacks. The VFD responds to the down hole torque demand, adjusting the pumping speed of the well. This pump-control ability has several benefits, including increasing oil production by ten percent and reducing capital expenses.

TENECO Energy LLC (CO) will use regenerating biochemicals (e.g., microbes and organic surfactants) to reverse formation damage, restore permeability and improve production in the East Texas field. Successful application of biochemicals should remove well bore deposits and improve production. Partners include MICRO-TES Inc. and Oil Patch Pipe and Supply.

Terra Exploration and Production Company (CA) will run newly-developed cased-hole well logs in a selected deep well in the Santa Fe Springs oil field in Los Angeles to identify bypassed oil. It is suspected that waterflooding of the more permeable sands has bypassed lower permeability yet oil-saturated sand intervals. Potentially productive zones will be identified, and nearby wells will be re-completed to increase recovery.

Stripper Well Consortium Funds 13 Projects

Soon after an early May meeting, the Stripper Well Consortium (SWC) announced the 13 projects that will receive funding during 2003. SWC base funding of $1.1 million comes from two funding sources (DOE’s National Energy Technology Laboratory and the New York State Energy Research and Development Authority). Participants also provide cost share. SWC focuses on the development, demonstration, and deployment of new technologies needed to improve the production performance of natural gas and petroleum stripper wells. Projects are selected by an Executive Council elected from among Consortium members. Sample projects from among the 13 are listed below.

Real-Time, Propellant Activation During Downhole-Mixed Fracture Stimulation Treatments, Realtime Zone, Inc. This project will develop and field test combining in situ solid propellant stimulation with downhole-mixed hydraulic fracturing. In the latter stages of a downhole-mixed hydraulic fracture treatment, solid propellants will be safely pumped down the casing for later-staged admixture with oxidizers to generate an energy release in the near wellbore and formation fractures. The process may use encapsulated or otherwise time-delayed chemical reactions to facilitate placement of the activated propellant further into the reservoir formation prior to reaction. Concept is to further extend the created hydraulic fracture, plus develop secondary fractures. The process will be tested in a Permian Basin well.

Low Cost, Downhole, Wireless Communications-Based Pressure & Temperature Gauge, Tubel Technologies. Leveraging knowledge gained through developing high-end products, Tubel will develop a low cost, downhole, wireless communications-based gauge that transmits acoustics data (of pressure and temperature) in real time through the production string. The new gauge can be deployed in production or injection wells. Battery pack of the downhole unit is expected to provide an operational life in excess of five years.

Variable Capacity, Positive Displacement, Spherical Compressor/Pump, W&W Vacuum & Compressors, Inc. The spherical geometry of the patented Weatherbie compressor/pump provides variable capacity capability at high efficiency. The pump’s large internal volume to surface area ratio enables it to, with each 360-degree rotation, displace nearly all of its internal volume. A unique volume control feature allows quick readjustment, making its use convenient where fluctuations in produced volume are common. The project will fund development of two, 4-in units that will be tested in the Texas A&M Turbomachinery Laboratory. Operating efficiency is expected to be 50% better than comparable pump/compressor installations.

Intellipipe™ Drilling System Performs Well in RMOTC Field Test

In the 4th Qtr 2002 issue of Network News, PTTC briefly mentioned the Intellipipe™ drilling system (www.pttc.org/news/4qtr2002/v8n49.htm#IntelliPipe) developed by Grant Prideco and Novatek Engineering with some DOE funding support. The system can transmit real-time downhole data at one million bits per second, a dramatic improvement compared to conventional mud pulse telemetry. Key to the new system is a unique non-contacting coupler embedded in the drill pipe connections. The coupler permits data to be sent across the connection and on through a high-speed cable attached to the inner pipe wall.

The first phase of a field test at the Rocky Mountain Oilfield Testing Center (RMOTC) focused on the communication system along the entire length of the drill pipe, in a cased hole environment, down to 3,054 ft. Electrical signals were transmitted down the drill pipe and returned by repeaters placed strategically along the length of the drill string. This procedure allowed “fine tuning” of the system to optimize placement of the repeaters in the drill string. In a second phase, cement plugs were set in openhole, then the system was used to drill through the plugs. During the week-long field test, the drilling system operated according to established test criteria and demonstrated that no special handling or make-up procedures were required.
Visit Grant Prideco's Intellipipe™ website (www.intellipipe.com/) for more information about the drilling system, or for further information about the RMOTC field test, contact Ralph Schulte, RMOTC (Ralph.Schulte@rmotc.doe.gov).

**Slurry Injection for Managing Drilling Wastes**

A May 2003 report by Argonne National Laboratory presents an "Evaluation of Slurry Injection Technology for Management of Drilling Wastes." Slurry injection involves processing solid materials to particles of suitable size and blending them with a fluid to make a slurry that is injected at pressures high enough to continuously fracture the formation receiving the slurry. Injection can be continuous or as a series of smaller-volume intermittent cycles. The report contains a database with full or partial information on 334 injection jobs from around the world (Alaska - 129, Gulf of Mexico - 66).

As the report notes, not all slurry injection jobs have been trouble-free but the reasons behind problems are understood and can be overcome with good design. Results from reviewing many projects reinforce that attractiveness of slurry injection must be determined on a site-specific basis. There are three critical factors that affect cost effectiveness—volume of material to be disposed, the regulatory climate, and the availability of low-cost onshore disposal infrastructure. In many locations, slurry injection compares favorably with conventional drilling waste management practices.

To access the full report, visit DOE’s NPTO website (www.nptd.doe.gov/publications/pdfs/SlurryInjRep.pdf).

**DOE Selects Three “Deep Trek” Projects**

DOE’s “Deep Trek” program targets developing “smart” yet economical systems tough enough to withstand the extreme conditions of deep reservoirs. Three recently announced R&D awards follow five earlier awards announced in September 2002 (see prior Tech line www.fe.doe.gov/techline/lt_deep-trek_2002sel.shtml). DOE is contributing slightly more than $11 million toward the three-year projects. Winning organizations will provide just over $5.5 million.

**Honeywell International** will develop a suite of high temperature electronic components that can be used for instrumentation in deep gas drilling systems where components can be exposed to temperatures from 250 degrees F to 437 degrees F for prolonged periods. Honeywell, which will conduct the project through its Solid State Electronics Center for Excellence, plans to combine and upgrade some of its existing electronics technology. It will form a Joint Industry Participation group to develop system specifications prior to product development. Potential partners in this group include Schlumberger Technology Corporation, Diamond Research, Micropac Industries, and E-Spectrum, as well as other petroleum industry service companies and operators. Total project cost is $8.6 million with DOE providing $6.0 million.

**Schlumberger Technology Corporation** plans to design and commercialize a high-temperature (approaching 400 degrees F), high-pressure, measurement-while-drilling tool that provides direction, inclination, toolface and gamma ray measurements continuously in real time. The tool will be fully retrievable while the drillstring is downhole, eliminating the need to remove the entire drillstring assembly to retrieve directional equipment. Deep well drilling economics will be improved with extended tool life, plus should it need to be replaced, less time will be lost since the tool will be fully retrievable without pulling the drillstring. Total project cost: $5.9 million with DOE providing $3.8 million.

**Cementing Solutions, Inc. (Watters Engineering)** proposes a combined effort with Argonne National Laboratory and other industry partners to develop “supercement” with superior pipe and formation-bonding capabilities at depths exceeding 15,000 ft. Industry authorities estimate that repairing failed cement jobs in deep, hot wells costs industry more than $100 million each year. Many failures occur because the Portland cement systems used today cannot stand up to the conditions in deep reservoirs. The team’s work will begin with laboratory analysis of various Portland and non-Portland materials and mixtures to identify compositions that provide the optimum mechanical properties for extreme conditions, followed by upscale testing to determine performance in larger quantities. Finally, the supercement will be tested in three to six field applications in hot, deep wells. Total project cost is $2.5 million with DOE providing $1.5 million.

For further information, see DOE’s Tech Line (www.fe.doe.gov/techline/lt_deeptrek_2003sel.shtml).

**DOE Microhole Initiative Proceeding**

DOE’s National Energy Technology Laboratory’s (NETL) Microhole Technologies initiative is being developed based on successes from Los Alamos National Lab’s Microdrilling feasibility study, a part of DOE’s National Lab Partnership Program. Initial feasibility and proof of concept studies have indicated that wellbore diameters of 2-3/8 to 1-3/4 inches (microholes) using coiled tubing drill rigs are possible. Field tests have demonstrated that small diameter holes can be drilled to depths of 700 feet using a small-footprint coiled tubing unit. Positive results from these field demonstrations, along with modelling and laboratory tests, indicate that drilling microholes to depths of 5,000 feet can be achieved with relatively modest modification of existing drilling equipment and coiled tubing technology. Two primary drivers for this technology focus are radically reduced cost of subsurface access, both for shallow reservoir development and for expanded use of borehole seismic for reduced exploration risk, and reduced cost for reservoir monitoring.

To assist in the planning process, Spears & Associates, Inc. recently prepared an initial market evaluation (www.nptd.doe.gov/news/micholSpearsMarEvalRep.PDF) documenting the state of the cased tubing market and trends in drilling costs in the U.S. Producers, service companies and equipment suppliers met in Albuquerque in late April to provide additional industry input as a roadmap for technology development is prepared. Topics discussed at the meeting included: potential uses and benefits, needed capabilities, enabling technologies, technological barriers, target drilling and completion costs, and barriers to market penetration.

Workshop participants identified four microhole technology application areas that have potential considering capabilities of current or near term technology and industry interest: 1) Shallow development wells; 2) Reservoir data monitoring holes; 3) Shallow re-entry wells (deepening and multi-laterals); and, 4) Deep exploration hole re-entry for deeper target investigation. The development of technologies for improved capability/reliability for drillout of 4-1/2” casing would be included in most of these Microhole Program focus areas.

Microdrilling technology along with micro-instrumentation could provide potentially low-cost wells for exploration, long-term reservoir monitoring, and production. Costs and drilling fluid/cuttings volumes could be expected to be as much as one-fifth current practices, providing significant economic and environmental incentives.

For further information, contact Roy Long, NETL, product manager, petroleum exploration and production, phone 918-699-2017, email Roy.Long@nptd.doe.gov.
Solutions From The Field

Seismic Imaging of Structural, Stratigraphic and Diagenetic Plays

March 6, 2003 (Morgantown, WV) sponsored by PTTC’s Appalachian Region

BOTTOM LINE
The focus of the workshop was on the use of seismic data for exploration and development of hydrocarbon resources. A survey of various techniques currently used for acquiring, processing and interpreting seismic data included a review of standard techniques and an update on new technologies.

PROBLEM ADDRESSED
Seismic processing and interpretation is extensively used by the majors and larger independents, but is often considered beyond the means of smaller independents. The recent advent of a number of low-cost seismic software programs to increase the speed and efficiency of processing, and assist the operator to interpret the data is a bonus to the independents operating in the Appalachian region. The workshop focused on learning how to plan and understand seismic data, and what software applications are available and how to use them.

Horizontal Drilling, Real Michigan Field Experience (Midwest)

March 20, 2003 (Mount Pleasant, MI) co-sponsored by PTTC’s Midwest Region and Michigan Satellite

BOTTOM LINE
From majors through very small independents, producers are drilling profitable horizontal wells/laterals/dual laterals in Michigan in application environments ranging from Niagaran reefs, carbonates, and Stray Sandstones to gas storage fields. Economic results indicate that wells don't necessarily have to be big wells to be profitable. Numerous case studies presented insights about locating horizontals, drilling, logging and production operations.

PROBLEM ADDRESSED
Independents in particular rely on field case studies as they make decisions about new technologies. Horizontal drilling is no longer a new technology, but there are still many applications where it could be used if producers had greater confidence in their ability to profitably execute horizontals. This workshop focused on case studies of horizontals being profitably applied in several different environments in Michigan.

Electronic Resources for NM Oil and Gas Data (Southwest)

Spring 2003 (New Mexico, Midland, TX) by PTTC’s Southwest Region

BOTTOM LINE
GO-TECH, the Gas and Oil Technology Exchange and Communication Highway, was founded in 1994 as a free access website to New Mexico oil and gas production information. The User Guide for Electronic Resources and the accompanying CD ROM database provides valuable information to New Mexico independent operators on resources and data and how to access them.

PROBLEM ADDRESSED
The state of New Mexico recognized a need to help producers who could not afford high priced software and data subscriptions to conduct oil and gas operations in New Mexico. Creation of GO-TECH and continued funding to respond to the requirements of New Mexico producers for fast, efficient, accurate and low-cost data and software is funded by the State of New Mexico and grants from the U. S. Department of Energy and the Petroleum Technology Transfer Council (PTTC).

Alerts Via E-Mail: Another PTTC Service

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American Oil and Gas Reporter
Tech Connection Column

June
Appalachian Model Provides Training Method For Well Tenders

May
Viewpoints Vary On Future Of Technology For Oil And Gas

April
Technology Spawns Increased Activity In Mature Kansas Oil Industry
Regional Roundup

2nd Quarter 2003 Case Studies
Petroleum Technology Digest

Oxy Permian’s Cogdell Unit CO₂ flood responds rapidly to CO₂ injection

Bottom Line: Oxy Permian, Ltd. (Oxy) is using CO₂ flooding to rejuvenate production in the Cogdell Unit, a Pennsylvanian Carbonate Reef field north of Snyder, Texas. Fast response is typical of high permeability reservoirs, but the blessing comes with reservoir management and sweep-intervention challenges to assure that the CO₂ sweep is efficient and lasting. Oxy uses an active reservoir surveillance program and makes sweep/profile modifications where necessary. Phase 2 development is planned during 2003. Assuming continuing success of the CO₂ flood, field life could be extended 25 years and add over 20 million barrels of oil recovery.

Electromagnetic survey defines reservoir, prevents drilling poor prospect

Bottom Line: A new electromagnetic (EM) survey technique developed by Montason Exploration, Inc., has been used to define areal extent of a Niobrara prospect in eastern Colorado’s Denver-Julesberg basin. The prospect, thought to have about three sq mi of structural closure, actually had only 400 acres of closure according to the EM survey. Considering remote pipeline access, the potential reserves were too small to warrant drilling. The EM survey and interpretation helped the operator avoid large land, exploration and development costs for the project.

Tips To Articles in Regional Newsletters

Rocky Mountain
Maps, Cross Sections and Database for Oil, Gas, and CO₂ Fields of the Paradox Basin (www.mines.edu/research/PTTC/newsletters/ volume%206/v6n2p1.html#paradox)

Texas

Coal Stratigraphy, Cretaceous Foreland Basin, Southwest Wyoming

Renowned expert, John Horne, led a PTTC-sponsored field seminar in Southwest Wyoming. Focus was on coal depositional environments and stratigraphic relationships. This photo from the Kemmerer mine illustrates the lateral variability and peat compaction in a coal sequence. The benches are about 50 feet high. This illustrates how correlating with one well per township can sometimes be a challenge. Dr. Horne has taught industry courses, is a former AAPG distinguished lecturer, and has more than 30 years technical and management experience in the petroleum industry.

Network News

CONTACT THE PTTC REGIONAL RESOURCE CENTER IN YOUR AREA:

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www.cgrpttc.lsu.edu

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www.energyconnect.com/pttc

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www.westcoastpttc.org

Michigan Satellite
William Harrison III
269-387-5488
http://wst023.west.wmich.edu/pttc.htm

Permian Basin
Bob Kiker
432-552-3432
www.energyconnect.com/pttc/pb/
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- Take useful information back to the office to apply to your day-to-day activities.

Register by 2 September and save!
For more information or to register, visit www.SPE.org/2003atce.

Network News
**PTTC’s low-cost regional workshops connect independent oil and gas producers with information about various upstream solutions. For information on the following events, that are sponsored or co-sponsored by PTTC, call the direct contact listed below or 1-888-THE-PTTC. Information also is available at [www.pttc.org](http://www.pttc.org). Please note that some topics, dates, and locations listed are subject to change.**

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<td>Tidelands Production Co.</td>
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<td>John King</td>
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<td>Major Companies</td>
<td>Greg Reep</td>
<td>Michigan Public Service Comm.</td>
<td>Lansing, MI</td>
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<td>Service Companies</td>
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<td>ChevronTexaco</td>
<td>San Francisco, CA</td>
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<td>David Morse</td>
<td>Schlumberger Oilfield Services</td>
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<td>PTTC Exec. Director</td>
<td>Don Duttlinger</td>
<td>Illinois Geological Survey</td>
<td>Champaign, IL</td>
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<td>Petrol. Tech. Transfer Council</td>
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