



Volunteers Essential For Technology Transfer

The reality is that much of technology transfer occurs outside formal business or corporate networks. Volunteers assuming roles in professional societies and producer associations, standards development subcommittees, conference organizers and R&D consortia provide the knowledge and labor to make organizations work. PTTC experiences first hand the results of many openhanded efforts. We commend all those who serve as "Technology Provokers."

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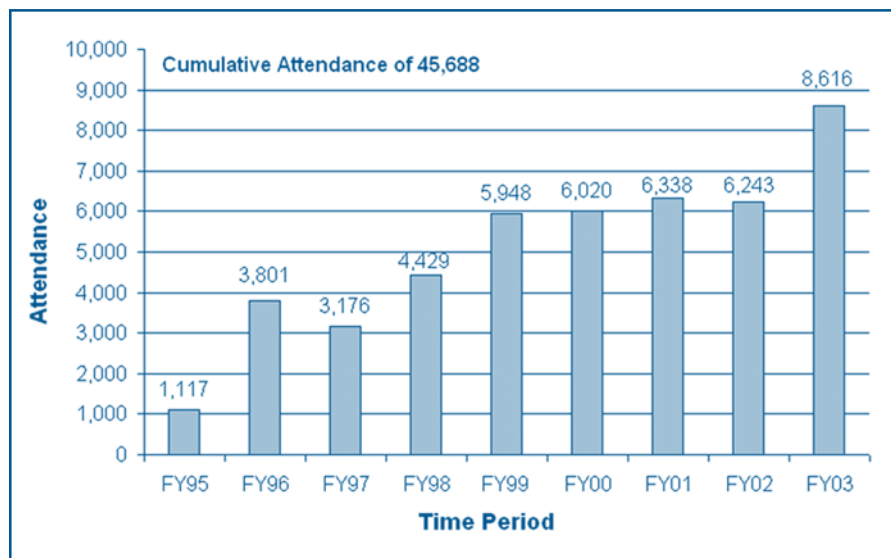
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PTTC is a national not-for-profit information network formed in 1993 by oil and natural gas producers. Programs are funded primarily by the US Department of Energy's (DOE) Office of Fossil Energy through the National Petroleum Technology Office (NPTO) 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.

Record Participation in PTTC Activities

The PTTC hosted approximately 8,600 participants in 161 regional and satellite office workshops around the country in fiscal year 2003. Since attendance tracking began in 1995, more than 45,000 participants have contributed to the technology transfer program with their time, money and industry expertise. This industry-state-federal partnership, with a mission of transferring upstream O&G technologies to producers to ensure a safe and reliable domestic energy resource, would not be possible without this enthusiastic support. The following article is intended to highlight the contributions of all Regional Lead Organizations that make the technology exchange successful and beneficial not only to the natural gas and oil community, but to the local governments and public at large.



Appalachian—A great deal of useful information has been presented in workshops on the Trenton-Black River play, which led to the GIS-based information now available on the regional website. The site also contains further information on horizontal and coalbed methane activity in the area. In addition, five Well Tender workshops in KY, OH, PA and WV drew nearly 600 participants last year.

Central Gulf—Data requested by Louisiana operators continue to be developed. Not only has the Louisiana Desktop Well Reference CD-ROM been kept updated, but staff worked with Louisiana's Department of Natural Resources (DNR) during 2002 to present a series of workshops showing operators how to use DNR's SONRIS system. Working with Core Laboratories, core-related workshops were held in Louisiana and Texas. Other workshops addressed several additional high-priority topics. Minor financial support continues to leverage results of LSU's Downhole Water Sink (DWS) Consortium.



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Eastern Gulf—Play-based workshops are known to have influenced industry. Speakers have subsequently worked with operators. Prospects are known to have occurred in several plays based on information presented during the workshops. Workshops are meeting CEU requirements of regional professionals. Extensive Mississippi geological information now online would not be there without PTTC support..

Midwest—Both the Michigan and Illinois websites are loaded with extensive local data; try the Interactive Map Server in the Illinois basin. Workshops with local case studies, such as the Horizontals in Michigan workshop that drew 197 participants last year, confirm the strong interest in local case studies. The Midwest Regional Lead Organization is providing a steady range of workshop topics that blend new technology with local case studies.

North Midcontinent—Activity during 2003 focused on documenting experience with four technologies-polymer gels, GasGunSM stimulations, 3-D seismic and coalbed methane-where operators are having success. This information and extensive digital data provided by the Kansas Geological Survey are viewed as a major asset.

Rocky Mountain—Staff maintains a highly active software training schedule, including a simulation users group. Software training covers desktop applications, GeoPlus PETRA, GeoGraphix, Seismic MicroTechnology, Divestco and others. The latest software venture is a "virtual" software and data fair (see p. 14). The region also develops technology workshops and is a partner in nearly all Rockies technology-oriented events. With successful launch of the "Futures in Energy" student intern program tomorrow's needs are being addressed.

South Midcontinent—Leverage is the name of the game here. Oklahoma's Marginal Well Commission (MWC) delivered 27 field-oriented workshops during FY03. There were also several technology-oriented workshops developed by the Oklahoma Geological

Survey, including eight workshops on "Produced Water and Associated Issues" that were part of PTTC's DOE-supported PUMP program. Activities in Arkansas have also been expanded.

Southwest—Just as in several regions, New Mexico operators benefit from a strong O&G data emphasis. Five workshops during 2003 focused on helping operators use these electronic resources. Resources include the recent New Mexico Well Location CD and a new State Land Office database. Timely special topics, such as the Mesa Verde field trip and workshop, or Produced Water forum, round out the regional workshop.

Texas—Bob Kiker's knowledge in the wellbore management arena has been leveraged in PTTC's PUMP program through workshops in several states. Strong participation in the 2002 CEED CO2 conference has led to an expanded format with sequestration topics and field trips in 2003. Gulf Coast outreach leverages BEG's core facility in Houston. Good use has been made of several lunch and learn presentations, and the Regional Lead Organization is exploring topical working groups to address technical challenges.

West Coast—Funding from the California Energy Commission is being utilized to supplement PTTC's DOE-supported PUMP program in California. The Regional Lead Organization is working with operators in small groups to identify produced water problems and solutions in different geological environments. Some field demonstrations are planned later in the effort. Monthly workshops on varied technology topics stimulate smaller producers to apply new technologies.

At the national level—PTTC continues to broadcast insights and case study results through timely E-mail Tech Alerts, monthly case studies and columns, this newsletter and an active exhibit schedule. Those attending IPAA's recent annual meeting in New Orleans also had the opportunity to experience a Tech Session addressing operational challenges from across the country. ♦

Meeting Alerts

AAPG Winter Education Conference

January 19-23, 2004
Houston, TX

www.aapg.org/education/wec.cfm

Managed Pressure Drilling Conference

January 27-29, 2004
Galveston, TX

<http://mpd04.events.pennnet.com>

SIPES Annual Meeting

March 18-19, 2004
San Antonio, TX

www.sipes.org

SIPES/ICoTA Coiled Tubing Conference

March 23-24, 2004
Houston, TX

www.spe.org/spe/jsp/meeting/0,2460,1104_1535_1451708,00.html

NACE Annual Conference

March 29 - April 1, 2004
New Orleans, LA

www.nace.org/corrosion2004

Cont. from page 1, Volunteers Essential...

Those doing the provoking are individuals who challenge past practices and develop creative ways of applying technology. They possess inquisitive minds that are able to take an idea and apply it with a combination of other ideas they have experienced to increase production figures or decrease operating costs. The vision of seeing beyond the next developmental step sets them apart. PTTC recognizes the vast contributions these participants deliver to the upstream oil and natural gas community. ♦



IOGCC Chairman's Stewardship Awards Received by Three "Checkoff" Programs

During its recent annual meeting, the Interstate Oil and Gas Compact Commission (IOGCC) announced three winners for its 2003 Chairman's Stewardship Awards. These awards honor outstanding achievements in conservation, environmental protection and energy education.

The **Illinois Petroleum Resources Board (IPRB)** was honored for its energy education program, which reaches more than 7,300 schoolchildren annually. The organization produced an education video, "The Story of Petroleum," which targets students in grades 5-8. IPRB produced a coloring book by the same name that helps children pre-kindergarten to grade 4. The IPRB's Rolling Oil and Gas Education Display Trailer complements the other educational efforts to demonstrate working scale models.

Additionally, an outdoor advertising campaign highlights remediated oil and gas sites and delivers the message, "Illinois oil and gas industry - taking the extra step and acting responsibly."

The **Ohio Oil and Gas Energy Education Program (OOGEEP)** developed "Responding to Oilfield Emergencies," a training program for local, county and state emergency responders and hazardous materials teams. "Responding to Oilfield Emergencies" offers hands-on training and creates live emergencies involving actual crude oil and natural gas situations. The program includes a training guide and compact disc. More than 300 emergency response officials from 22 counties have successfully completed the training.

The **Oklahoma Energy Resources Board (OERB)**, in partnership with the U.S. Environmental Protection Agency (EPA) and the Oklahoma Corporation Commission (OCC), took on the job of plugging wells near Lake Oologah near Tulsa. Lake Oologah is part of a large, mature oil field that is reportedly 100 years old. Hundreds of wells had been drilled over the years, then abandoned. Unplugged or incorrectly plugged wells are now leaking. Within this effort, more than 500 shallow wells have already been plugged. Work will continue for years plugging the remaining wells.

Excerpted from IOGCC press release, Oct. 20, 2003 (www.iogcc.state.ok.us/). ♦

AESC Safety Handbook, Safe Procedures & Guidelines for O&G Well Servicing

Developed by contractors as an aid to preventing accidents, this 7"x9" handbook has become the reference source for safe procedures in well servicing. This loose leaf binder, which is printed on oil and grease resistant paper, is available through the Association of Energy Service Contractors (AESC) for \$45 (\$22.50 for members).

Visit www.aesc.net/Store/ to order, or call 800-692-0771. ♦

Managing Workers' Comp Costs

Increases in workers' comp insurance costs are an unfortunate "fact of life," but there are things one can do to manage costs.

Increase workplace safety—Operators should identify and address the riskiest areas of their operations. Insurance providers look at track records. They want evidence that one is reducing accident frequency and severity through modifications/training.

Get employees back to work quickly—When workers have accidents, it's the "staying at home" part that is often most costly. This includes costs for replacement workers, or less experience in those who are the replacement worker. One solution is to create temporary positions for injured workers. The trick is to develop productive positions for which the worker's injury does not rule out participation.

Communicate the need for controlling costs—Open employees eyes to how their track record affects costs, which can directly affect a company's profitability. Express genuine concern for injured workers, which keeps things from becoming adversarial. Make sure the doctors know the demands of the normal and temporary position, and are taking care of needs while not prescribing more than needed.

Excerpted from "Workers' Compensation - Putting A Lid On Costs," Phillip Perry, Well Servicing, Sep/Oct 2003, p. 18-21. ♦

Injuries Reduced With Hands-Free Rig Operations

In its drilling operations worldwide, Noble Corp. has reduced reportable hand finger injuries resulting from material-handling incidents by two-thirds over a three-year period, from 12 in 2001 to two in the first half of 2003.

When evaluating how to reduce injuries early in 2001, a Noble team quickly recognized that if a worker never touched cargo directly, chances of hand and finger injuries would be greatly reduced. In 2001 the concept of hands-free operation was tested over a three-month period on eight rigs, then expanded to a formal policy for implementation fleetwide. To quote from the article, the concept is simple.

"No person working on board a Noble rig will touch a load, sling, or wire line while a load is suspended and there is tension in the rigging. All loads will be controlled through the use of dedicated taglines or by the crane and its operators."

The article goes on to describe the nuances of achieving hands-free operations. Recognizing that there would inevitably be exceptions to hands-free operations, Noble planned ahead and developed strict guidelines for deviations, each of which requires approval by the offshore installation or rig manager. Noble makes it clear to workers that this advance permission must be obtained or they should not proceed. Workers and Noble are benefiting from the policy.

Excerpted from "Hands Free System Reduces Rig Injuries," Mike Cadigan, Noble Corp., Oil and Gas Journal, Oct. 13, 2003, p. 57-59. ♦

Natural Gas Produced Water Management Decision Tree Model

A recent report by the Gas Technology Institute (GTI) summarizes produced water disposal practices and regulatory issues at a local level, presenting data on produced water management practices used in 30 selected basins in 10 states. The data can be accessed through a software tool called the Produced Water Management Decision Tree Model (PWM DTM) that was developed as part of the project. The PWM DTM provides oil, gas and water production statistics along with Internet links to the appropriate regulatory agencies for each state considered. It also provides general information describing each reported PWM technology and the pros and cons of owner-operated and commercial technology application.

Cost for report and software on CD-ROM is \$75, Document #GRI-03/0072, which can be ordered from GTI's website (www.gastechnology.org). ♦



PTTC recognizes that products and services featured in "Tech Transfer Track" may not be unique and welcomes information about other upstream technologies. PTTC does not endorse or recommend any of the products or services mentioned in this publication, even though reasonable steps are taken to ensure the reliability of information sources. Input can be directed to HQ@pttc.org.

Thoughts From Leaders of Top Independents

In addition to general observations about the bullish outlook for independents, this recent article in the *Oil & Gas Journal* (OGJ) contained sidebars presenting thoughts from top executives of the fastest-growing US independents, in terms of stockholder equity according to company ranking in the latest OGJ survey (OGJ, Sept. 15, 2003, p. 48). If you missed the article, it seems one could glean wisdom from the leaders of these fast growing companies. Just looking at the growth strategies below, it is apparent that there are multiple paths to growth and profitability.

- **Magnum Hunter Resources, Inc.:** Maintains a contrarian strategy of targeting acquisition and exploitation of long-lived reserves when commodity prices are low.
- **Remington Oil & Gas Corp.:** Focuses on shallow-water GOM where quick returns can be realized; relies heavily on an extensive 3-D seismic database
- **Devon Energy Corp.:** Builds through acquisition, exploration and exploitation; heavily-weighted towards natural gas and North America.
- **Pogo Producing Co.:** Grows through highly selective acquisition and exploration.
- **Berry Petroleum Co.:** Diversifying from heavy oil in California to gas and light oil through acquisitions with high development potential.
- **PetroCorp Inc.:** Recently purchased by Unit Corp. Before acquisition, a focus on acquiring long-life gas reserves with additional development/exploitation potential.
- **Ultra Petroleum Corp.:** Focus on developing identified drilling opportunities in core assets in southwestern Wyoming and Bohai Bay in China.
- **Quest Resources Inc.:** Concentrates on coalbed methane in Cherokee basin, with expansion into coalbed methane in Kentucky

- **GeoResources Inc.:** Concentration in the Williston basin; operates a contract drilling subsidiary and coal mine that produces specialty products.

Excerpted from "US Independents Maintain Bullish Outlook Despite Legislative Uncertainty," Sam Fletcher, Paula Dittrick and Steven Poruban, Oil and Gas Journal, Oct. 27, 2003, pp. 24-42. ♦

3% Micro-Alloy, Alternative For Severe Sweet Corrosion

"Sweet" or CO₂ corrosion environments can be severe, increasing inhibition costs to very high levels or even requiring 13% stainless steel for the most severe environments. Through extensive research, Tenaris discovered that a 3% Cr micro-alloy would exhibit corrosion performance much better than inhibited carbon steel. With the lower Cr content, cost is much less than traditional stainless steel. The micro-alloy with the lower Cr content still exhibits more than satisfactory mechanical properties.

Tenaris compared whole life costs of the 3% Cr micro-alloy with that of inhibited carbon steel and 13% Cr stainless steel for 12,000 ft of 4.5-in 12.6 lb/ft tubing. Net cost considering present value was determined for times ranging from four to 20 years. Net cost with the 3% Cr micro-alloy was significantly better than the other alternatives. As a point of interest, net cost was highest for inhibited carbon steel.

Excerpted from "Less Is More When Fighting Corrosion," J.C. Gonzalez and G.L. Turconl, Hart's E&P, October 2003, p. 69. More information online at www.tenaris.com. ♦

Gulf of Mexico Decommissioning Costs

A recent study has established relationships that allow one to estimate decommissioning costs of Gulf of Mexico (GOM) oil and gas production structures. In the GOM about 2,000 structures have been removed. Removal costs are known to some extent at the operator level, but such data are not publicly available nor reported to the Minerals Management Service. Twatchman, Snyder and Byrd, Inc. (TSB) serves as a third party

in decommissioning planning and managing and has managed more than 200 GOM projects since 1987. Its database on these projects, which served as the source for cost data in this analysis, contains cost elements for projects managed by TSB since 1991.

Data were reviewed and filtered, eliminating projects with ambiguous or incomplete entries. The analysis excluded projects currently in progress, projects that reported costs for only one service category, or projects that involved more than three removals per job. The final data set encompassed 60 structure removals from the 1991 to 2001 time frame.

Normalized by structure complexity on a per-pile basis, the removal cost is \$107,000 per pile for a four-pile structure and \$75,000 per pile for an eight-pile structure, economies of scale. The single most important cost category is the structure removal stage. Accordingly, any activity minimizing the time a derrick barge spread is on site will reduce costs significantly. Well P&A, pipeline abandonment, structure preparation and diving costs each generally represent about 10% of the cost. P&A costs tend to increase with water depth.

Regression equations were developed as a function of water depth for three-pile, four-pile and eight-pile structures. For four-pile structures, total cost ranged from \$0.5 to \$2.0 million at water depth of 250 ft. Estimates developed using these cost functions will not replace site-specific engineering, but they can complement site-specific work and are valuable as a guide for less experienced staff.

Excerpted from "Study Estimates Gulf of Mexico Decommissioning Costs," M.J. Kaiser and A.G. Pulsipher, Louisiana State University and R.C. Byrd, Twatchman, Snyder and Byrd, Inc., Oil and Gas Journal, Oct. 6, 2003, pp. 39-47. ♦

X-Cube Filter Removes H₂S From Low-Pressure Sour Gas Vents

Desert Energy Equipment, Inc., Odessa, Texas, recently released its X-Cube filter for removing H₂S from low-pressure sour gas, such as might come from wells, tank batteries and water disposal filters. No surprise that the product comes from the Permian Basin where the "smell of money" often permeates the air.



The sour gas is flowed through a solvent inside the cube where the hydrogen molecules bond with the solvent. The only maintenance is to drain the used solvent and replace it with a fresh supply. The technology is proven but had never before been miniaturized to handle low-pressure vent gas from tank batteries or disposal facilities. Plans are to offer the product to the trucking industry in the near future.

One unit has already been placed on a saltwater disposal well in Denver City, where loaded product would cause gas to vent and the neighbors to complain to regulators about the odor. The X-cube was installed and vapors monitored. The problem was solved, the regulatory agencies didn't have to assess fines and the neighbors were happy. According to Billy Bob Anderson, sales manager with Desert Energy, the Texas Railroad Commission, for one, has given its blessing to the technology, seeing it as a way to treat low-pressure, low-volume sour gas at a much lower cost. X-Cube is manufactured locally and is now being marketed in the Permian Basin.

Excerpted from article in "MyWestTexas.com" dated Nov. 16, 2003 (www.mywesttexas.com/site/news.cfm?newsid=10522580&BRD=2288&PAG=461&dept_id=474107&rfti=6). Desert Energy Equipment, Inc., Odessa, TX, phone 432-381-3321. ♦

Compressor Optimization Increases Profits

Some 2000 compressors across the world are now being monitored with Analysis, a proprietary compressor analysis and fleet-management program developed by Detection Technologies (www.detection.com/) to improve performance and reliability of reciprocating and screw compressors. Analysis is a diagnostic tool that combines individual compressor optimization and total compressor fleet management in one function. Examples were cited for two Canadian producers where compressor utilization was increased from 9% to 11%. There are other benefits beyond increased compressor utilization.

After an initial one-time collection of manufacturers' design data and compressor site-specific conditions, diagnostic reports can be quickly generated by entering key operating parameters (via phone, fax, Internet or SCADA). The software is based on the belief that virtually all compressor operational inefficiencies and maintenance problems can be detected by looking at eight operating categories. Every diagnostic report lists these cat-

egories and indicates problems that exist within each one. Going a step beyond merely identifying problems, the software also provides specific recommendations for improving compressor operations. Operators particularly like this feature. Another feature quantifies financial risk to the operator related to each compressor's operational status and condition. This allows operators to quickly focus their efforts on areas where maximum economic benefit can be realized.

Excerpted from "Increasing Upstream Profit Through Compressor Optimization," Cavan Carlton and Andrew Miles, World Oil, September 2003, p. 52-54 available online (www.worldoil.com/magazine/MAGAZINE_DTAIL.asp?ART_ID=2114&MONTH_YEAR=Sep-2003). ♦

Advancements in Relative Permeability Modifiers

High water production is often a fact of life in mature fields. Polymer gel treatments often work well in blocking operations, as documented in professional literature and in a recent PTTC website (www.nmcpttc.org/gel/index.html). Polymer gel treatments are often applied in fractured reservoirs. Mechanical solutions can work well in the alternating sand-shale environment of many California fields. Managing water in thick, uniform high permeability GOM reservoirs is a different matter. In that case, one choice is relative permeability modifiers (RPMs). Early products years ago had limitations, but technology providers indicate today's products have improved considerably.

RPMs are polymers chemically structured so as to attach themselves to water-wet rock surfaces and fill nearby pore throats while limiting the swelling in higher oil-saturated rock. The goal is to decrease water permeability while leaving oil permeability unaffected. Compared to early products, today's chemicals have a stronger affinity toward water swelling and adhering to the rock. That, combined with improved applications knowledge, indicates RPM technology is ready for another run.

Two technology providers have recently commercialized products, and other technology providers are working on RPM applications. BJ Services' AquaCon has been commercial for about 18 months. It comes in two versions, a standard version and AquaCon HP designed for high permeability and high temperature zones. Halliburton's RPM product comes in three products: its remedial WaterWeb, the fracturing additive CW-Frac

and Guidon AGS (acid guidance system) to direct acid away from water zones where it is naturally attracted to hydrocarbon-bearing zones. Other technology providers are also working on RPM technologies.

Service providers agree that understanding the true flow regime is the key to candidate selection. RPMs are not appropriate for fractured reservoir applications, so sandstone reservoirs are highly preferred since carbonates often have dominant fractures or voids. Care should be taken in sandstones that flow there is not unduly influenced by fractures. Application guidelines are expected to evolve as more experience is gained with the new generation of RPM products. Providers acknowledge that success rates with RPMs will probably not reach the 90% plus range experienced with properly applied blocking treatments, but one notes that they consider an 80% success rate achievable.

Readers are encouraged to read the entire article to see what's new with RPMs. Excerpted from "RPMs And The Holy Grail," Rick von Flatern, Offshore Engineer, December 2003, P. 23-27. Available online at www.offshore-engineer.com/. ♦

Alternate Method for Forecasting Production From Waterflooded Reservoirs

Mature waterfloods typically have abundant production data. While easy to perform, conventional forecasts with decline curve analysis tend to be conservative. Simulation is generally too time intensive, plus results can be poor when trying to predict individual well production. Industry generally accepts volume-based prediction using log water-oil ratio (WOR) vs. cumulative oil plots. This alternate method converts accepted volume-based relationship to a time-based estimate. A presented example compares the forecast using the new technique with that from decline curve analysis, which was too conservative. The authors note the technique has successfully been applied for well- and zone-level predictions, workover evaluations and asset evaluations. The technique is very amenable to spreadsheet analysis.

Excerpted from "Technique Forecasts Production From Waterflooded Reservoirs," Bob Harrison, TriPhase Consulting Ltd. and Andrew Warnock, Encana UK Ltd., Oil & Gas Journal, Nov. 24, 2003, pp. 55-60. ♦



***Did we miss some field test sites?
Email us the information and
we'll expand this article. (click here)***

Oilfield Testing Centers: Nurseries For New Ideas

by Karl Lang

An endangered species that once prowled major companies, known as "the R&D group" (*departmentsis researchii develop-menta*), has for all intents and purposes become extinct. Wall Street pressure for short-term profit performance proved just as deadly as a Permian meteor. A few service companies have evolved organizational units to partially fill the ecological niche, but the overall level of industry expenditure on upstream R&D has dropped to less than one percent of total annual E&P expenditures, roughly half of what it was ten years ago. Much of the research infrastructure has slowly disappeared as well, including wells and drilling sites that both E&P and service companies maintained as part of their R&D centers. Such sites provided a very well understood yet relatively risk-free subsurface environment where new tools and techniques could be tested and evaluated under proprietary conditions, without the need to shut in or interrupt field operations.

But a few sites have managed to escape extinction and are actively in use as test centers. At least one new facility is under construction. Highlighted below are some better-known examples. If the E&P industry is to continue its record of continued technology advances, facilities like these will be needed as "nurseries" for new ideas. Also, as smaller companies take on a larger role in developing and commercializing new E&P technologies, facilities such as these become even more important.

Rocky Mountain Oilfield Testing Center

The Rocky Mountain Oilfield Testing Center (RMOTC) includes a management and administrative office located in downtown Casper, Wyoming, and an extensive field test site at the Naval Petroleum Reserve No. 3 (the Teapot Dome field) located 35 miles north in the southern end of the Powder River Basin. RMOTC was created in 1994 as

a way to convert a portion of the Naval Petroleum Reserve into a field laboratory for the advancement of technologies that support domestic oil and gas production. The NPR-3 field test site is a 10,000-acre operating oil field offering a full complement of associated facilities and equipment on-site. There are approximately 900 well bores and 500 producing wells in nine producing reservoirs ranging in depth from 250 ft. to 6,000 ft. Average production in fiscal year 2002 was 500 bopd and 40,000 bwpd. Production is primarily light, sweet (low sulfur) crude. Some production from the Tensleep formation is sour.

Conditions at Teapot Dome field are representative of sedimentary basins throughout the Rocky Mountain west. The geologic column at NPR-3 extends from Upper Cretaceous marine sandstones and shales down to metamorphic and intrusive Precambrian basement. RMOTC is available for both technical and environmental testing of new technologies associated with regional energy developments. Accordingly, RMOTC has established a Western Energy Development Office. From the wide range of possible energy development opportunities and their associated issues, this office selects those few to which RMOTC resources can be most effectively applied. For the issues selected, stakeholders are identified and alliances formed to find solutions that are technically and environmentally sound, and to communicate those solutions back to decision makers.

The on-site facilities and equipment significantly reduce the cost of field testing at RMOTC. Should a field test require equipment not already on site, because the oil and gas industry is active in the region, it is commonly available in the local area. In-place facilities and equipment include: test batteries and test satellites, treaters, tanks, transfer pumps and a 10 MMcfd gas plant.

RMOTC also operates a completely equipped, winterized truck-mounted rotary table rig rated for drilling safely to a depth of 6,500 ft with 4-1/2 inch drill pipe. The rig has a 112 ft high mast rated to 300,000 lbs with eight lines. The rig can be utilized for testing on the current test well or can be moved to other wells and/or locations in the field.

RMOTC field equipment includes workover and well servicing rigs, available for field test projects: two Kremco K-600 double drum units with 103'/217,000 lb. hydraulic raised derricks capable of standing double tubing and hanging triple rods, and one Wagner Morehouse T-34 double drum rig with a 63'/150,000 lb. hydraulic raised single piece derrick capable of standing single tubing and hanging single rods. The center also maintains a variety of earth moving equipment and trucks.

During 2002, a total of 18 newly funded testing projects were undertaken at RMOTC related to drilling, production and environmental site remediation technologies. While four of these involved large industry partners (e.g., Schlumberger, Weatherford, Baker-Atlas) the large majority involved small companies. Many EOR methods have also been used and field tested at NPR-3. The equipment and facilities necessary to support steamflood, enhanced waterflood, microbial and other EOR methods are available for field tests. Currently, RMOTC is partnering with Anadarko Petroleum Company and a number of universities and national laboratories to conduct carbon sequestration studies in association with Anadarko's CO₂ flood at its adjacent Salt Creek field. RMOTC has also been tabbed as a preferred location for new microhole and directional drilling test facilities.

For more information, contact Doug Tunison, RMOTC Manager, phone 307-261-5000 ext 5006, E-mail doug.tunison@rmotc.doe.gov. For online information visit www.rmotc.com.



Gas Technology Institute Catoosa Test Facility

Built in the mid-1980s by Amoco as a proprietary testing ground for downhole tools and equipment, Catoosa was divested by BP after its purchase of Amoco in the late 1990s. Now officially named the Gas Technology Institute Geophysical and Drilling Technology Testing and Evaluation Facility (or more commonly as GTI Catoosa), the 80-acre site is commercially available for customer-directed R&D related to drilling, formation evaluation, geophysical, completion and any other oilfield or environmental research. The GTI leasehold allows new wells to be drilled or any of 26 existing wellbores to be utilized for testing. Permanently dedicated "reference" wells are available for use in calibrating or comparing the responses of downhole instruments. On-site equipment (drilling rigs, wireline unit, drilling fluids laboratory) and surface infrastructure (data acquisition facility, office, warehouse, welding shop) are all available to support field-based research efforts.

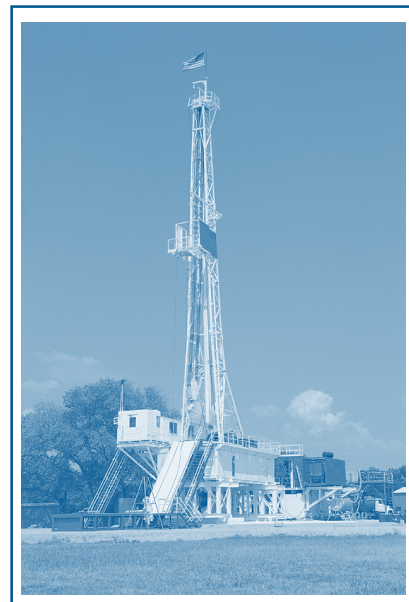
The site boasts a variety of geological formations at relatively shallow depths (down to 3100 ft); a feature that enables a broad range of testing options. The first 1250 ft is a mixture of Pennsylvanian reservoir-quality sandstones with shale and limestone sequences. These include the Oswego Limestone, the Skinner, Red Fork, and Bartlesville Sandstones, and the Upper and Lower Brown Limestone. From 1250 ft to 1600 ft is found a very dense and high-compressive strength formation (Mississippi Lime). A thick Cambro-Ordovician limestone (Arbuckle Group) extends across the interval from 1600 ft to a granite basement at 3000 ft.

The rock types represented in this section, having compressive strengths ranging from 1,000 to 60,000 psi, provide an ideal environment for testing bits and downhole tools. In addition, the fluid content of the porous rocks includes connate water and (in certain sections) hydrocarbons, providing for a degree of variability in fluid character. The

shale and sandstone sections in the upper 1250 ft of the subsurface are good for testing equipment across a transition from soft to hard rock and back. A wealth of electric, acoustic and radioactive log data, as well as a continuous core from the surface to 2500 ft, are also available. The 26 wells at Catoosa include straight, directional and horizontal holes with casing sizes of 22-, 23 3/8 -, 9 5/8 -, 7- and 5-inches. Openhole wellbores of 12 1/4, 8 1/2 and 6-inches are also available. There are two horizontal wellbores (TVD/MD:1187/2118' & 1200/1700').

Rig equipment includes a top-drive drilling rig with a 107 ft double mast derrick and a drawworks rated at 220,000 lbs. A trailer mounted Chicago-Pneumatic workover rig, rated to 20,000 lb and capable of horizontal drilling is also available. The drilling rig also incorporates the Sperry-Sun Services Integrated System for Information Technology and Engineering (INSITE™), which allows for real-time data acquisition and viewing.

Practically any sort of onshore drilling and formation evaluation equipment can be test-

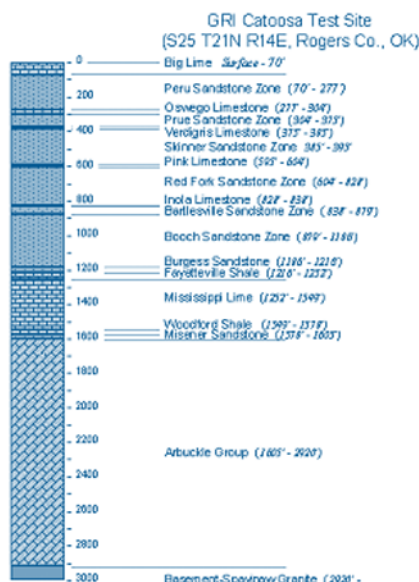


Catoosa Rig on Location

ed at Catoosa, including rotary steerable systems, MWD and LWD, and both open and cased hole wireline logging. The Catoosa site offers a unique setting for testing deep-reading formation evaluation and high-frequency seismic tools, and for the calibration and verification of new logging tools. The closely located wells, controlled conditions, the existence of cores, and the well-described geology of the site are unique and easily accessible.

The site is also an ideal test bed for new geophysical methods and techniques, from numerical models to field validation. Potential tests could include: vertical cable seismic tests, new seismic techniques, data sales, converted-wave seismic tests, and horizontal-well seismic tomography. The site can also be used for assessing the environmental performance and acceptability of new drilling mud systems or environmental monitoring devices (such as ground penetrating radar, laser-based subsidence systems, or leak detection equipment).

For more information about the GTI Catoosa Test Facility, visit the Gas Technology Institute website (www.gastechnology.org), or contact Ron Bray, phone 877-477-1910, E-mail rbray@gticatoosa.com.



GTI Catoosa Site Geologic Column



Texas Tech Center for Advanced Production Research Operations (CAPRO)

The Texas Tech University Test Well (Red Raider No. 1) is 4006 feet deep and completed with 9-5/8 inch, 43.5 lb/ft., N-80 casing. The geology is typical of the northern Permian Basin. The purpose of the well, drilled by the university in December 2001, is to provide a location for training undergraduate students in oil field operations. In addition, this well can be used as a full-scale research facility for the installation, testing, and development of oil and gas production equipment by industry. The test well is operated under the Center of Advanced Production Research Operations (CAPRO) at the university. The well and its related surface equipment provide the West Texas oil and gas industry with an ideal location for the evaluation of new artificial lift technologies in particular.

The Test Well Facility is located on 8.7 acres of university property in Lubbock, Texas. During 2004, the Department of Petroleum Engineering will continue its expansion of the production equipment associated with the test well. New equipment scheduled for installation will include crude oil and water

storage tanks, a gas sales pipeline connection, pump stations, metering and measurement packages, separation units, and treating units. When completed, the Texas Tech Test Well Facility will be capable of testing all forms of artificial lift at anticipated rates as high as 10,000 barrels per day of liquid and three million cubic feet per day of gas. Future plans include the installation of a series of horizontal flow loops for the study of multiphase flow.

The well was drilled using donations from industry. Approximately \$625,000 of equipment and services was received from more than 20 contributing companies. CAPRO is continuing the procurement stage for the production facilities. Donations include a two-phase separator and heater treater, a Lufkin C456D-305-144 pumping unit with pump-off controller, a gas compressor, an electrical submersible pump pumping unit, a sucker rod wellhead assembly and sucker rods, and a complete plunger lift system.

CAPRO is pursuing a connection to an existing natural gas pipeline to provide fuel for the surface facilities, to enable the commingling of gas, oil and water for production testing and multiphase equipment testing, and to operate gas lift and plunger lift equipment.

For additional information on the status and availability of the test facility, contact James "Chris" Cox, Assistant Professor Texas Tech University at (806) 742-3573 or via e-mail (chris.cox@coe.ttu.edu). For online information visit <http://129.118.21.70/>.

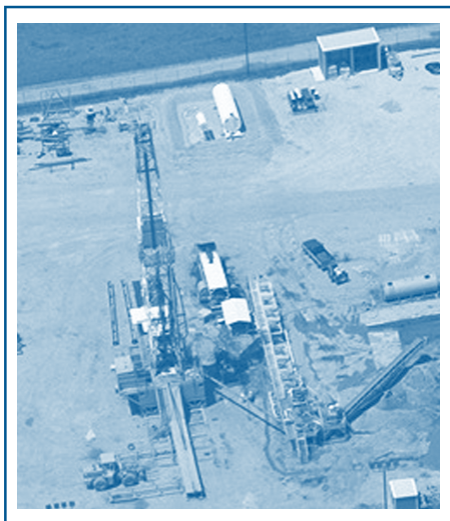
Baker Hughes Experimental Test Area (BETA)

In 1997 Baker Hughes began construction of a field research facility 24 miles south of Tulsa at Beggs, OK. Since coring the first observation well in 1997, Baker Hughes has drilled roughly 100,000 feet in 40+ wells. Primarily employed as a field laboratory for testing of new Baker Hughes-developed drilling and completion equipment, it is not generally open for outside testing. The BETA site has been part of the development of a number of new Baker Hughes products including: the CoreDrill wireline coring system, the CoPilot vibration measurement tool, Autotrak rotary steerable system, e2Tech expandable tubulars, and PDC bit cutters.

The geology is very similar to that of the Catoosa site, which is only about 50 miles away. A Pennsylvanian section extends from the surface to 2,250 ft, followed by a Mississippian section from 2250 to 2660, and an Ordovician section from 2660 to a

Summary of Facilities

Facility	Operator	Location	Wells	Max Depth	Completion	Geology	Primary Attributes
RMOTC (www.rmotc.com)	US Gov't.	Teapot Dome Field, WY (35 mi north of Casper)	600 Wells producing oil and gas from six zones	6000 ft	Various	Cretaceous and Pennsylvanian sandstones and shales	<ul style="list-style-type: none"> Operating oilfield Government partnerships Large area (10,000 acres) On-Site technical staff
Catoosa (www.gastech-nology.org)	GTI	Catoosa OK (18 mi east of Tulsa)	26 existing wells, non-producing	3000 ft	Open and cased holes, vertical and horizontal	Pennsylvanian sediments over Arbuckle Group limestone	<ul style="list-style-type: none"> Low-risk testing environment Easily accessed location Dedicated reference wells On-site technical staff
CAPRO (http://129.118.21.70)	Texas Tech	Lubbock, TX	1 well	4000 ft	9/ 58 casing (unperforated)	Northern West Texas sandstones and carbonates	<ul style="list-style-type: none"> West Texas location New production equipment Ideal for artificial lift testing
BETA	Baker Hughes	Beggs, OK (24 mi south of Tulsa)	62 wells, more than 166,000 ft of drilling combined.	As needed, to 3000 ft	Wells not completed	Similar to Catoosa with thicker and deeper sections, including sandstones	<ul style="list-style-type: none"> State-of-the-art drilling data collection and analysis Well-described geology with variety of rock types Easily accessed location



BETA Test Site

granite base at about 3000 ft. The formations include sandstone, limestone, shale, coal, dolomite and granite. Shale is the predominant rock type above 2400 feet (more than 70 percent of the section, with sandstone and siltstone making up the rest). Below that depth, limestone, sandstone, shale and dolomite are encountered in approximately equal proportions. Numerous thin coal beds are encountered and many of the formations still contain residual amounts of oil and gas. A large variation in rock strength makes the BETA site ideal for testing downhole tools and systems. Because the entire section between the surface and basement has been cored and extensively logged, detailed petrophysical descriptions are available for any formation of interest.

Drilling at BETA is accomplished with a carrier-based Ideco H35 truck-mounted rig with a freestanding mast capable of 350,000 lbs hookload. At 110 feet, the mast can handle doubles and hold 60 stands of pipe. The substructure is mounted on a skid system and can be quickly moved from one hole to the next. Rotation is with a Tesco 150 ton topdrive operated by a 550 hp Caterpillar 3406E engine. The mud pump horsepower (1300 hp) rating is higher than normal for the area, driven by the need to test LWD, MWD and mud motor tools.

The BETA data collection system is designed to allow high-speed data collection and real-time frequency domain analysis. Sensors are

used to measure torque, rpm, pump pressure, flowrate, vibration and hook-load. Pump flow rate is measured with both stroke count and magnetic flow-meter systems. A surface Dynamics Measurement System (SDMS) sub placed directly beneath the top drive is capable of sampling four dynamic channels (axial force, axial acceleration, torque and torsional acceleration) and four static channels (hook load, torque, rotary speed and standpipe pressure).

The BETA site also boasts state-of-the-art data collection software, still photography and video capabilities, and a local file server supporting the BETA website. Baker Hughes does not open the BETA test facility to commercial use by the E&P industry and has no plans to do so in the future. However, several collaborative joint ventures have utilized the facility recently, for example: Shell Expro (E² Tech and Expandable Reamer) and Chevron Texaco (Drill Out Steerable Ream While Drilling (DOSRWD) Technology). Baker Hughes has also run non-competitive service company tools at the site to test for compatibility with BHI products and services.

Hughes Christensen contacts include, Allen Sinor (phone 281-363-6460, e-mail allen.sinor@hugheschris.com) or Jim Powers (phone 918-267-3911, e-mail jim.powers@hugheschris.com).

Centers Provide Valuable Service

While not the only field testing centers in existence, the four centers highlighted above are perhaps several of the better known examples operating in the US. Two other test facilities that incorporate actual wellbores, one operated by Schlumberger and the other by Louisiana State University, are described in the online version of this article at (www.pttc.org). Not all are available to the public for testing and development, a function that is critical for smaller companies developing exploration and production technologies for the more mature producing areas in the US market. PTTC would like to catalog field test facilities available to the public, so please contact Lance Cole (lcole@pttc.org) if you are aware of facilities not mentioned in this article. ♦

For further information, contact Lance Cole at lcole@pttc.org.

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George R. Brown Convention Center

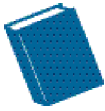
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Composite Drill Pipe Passes Another Oklahoma Field Test

Lightweight, carbon fiber composite drill pipe, developed by Advanced Composite Products and Technology in California, performed well in a horizontal gas well in Le Flore County, Oklahoma during summer 2003. Performance in earlier oil well reentries in Tulsa County, Oklahoma was reported in 1st Quarter Network News (www.pttc.org/news/1qtr2003/v9n1p10.htm#2). The flexible pipe is manufactured by winding graphite fibers and epoxy resin around a spindle. The composite tube is cured, and the supporting spindle is removed. The pipe is machined, and then coated to resist abrasion. It was developed in a \$2.82 million, five-year DOE project.

This most recent test was conducted at a depth of 1,385 feet in a hard, abrasive formation. Unlike earlier testing that used rotary drilling tools to re-enter existing wells, the latest test was conducted in a new well using air-hammer drilling. The air hammer severely challenged the pipe's fatigue life, mechanical strength, and ability to deal with stress. After a week of drilling, the pipe was extracted and examined. It showed little or no signs of wear. Steel drill pipe, by contrast, can suffer fracturing and rapid wear when continually bent in a horizontal drilling operation.

While the price of the composite pipe is currently about three times the cost of steel drill pipe, researchers are working to reduce this cost. They also plan additional tests in the coming months to ensure industry confidence. Future work will include embedding wire in larger, 7-inch composite drill pipe to carry the data from the bottom of the hole to the surface while drilling is ongoing. With digital communications capability, "smart" drilling systems can give operators critical real-time data.

Excerpted from DOE Tech Line (www.fe.doe.gov/news/techlines/03/tl_compositedrillpipe.html). Contact DOE NETL's David Anna, phone (412)-386-4646, E-mail anna@netl.doe.gov, for more information. ♦

GEMINI Software Now Available from KGS

Newly developed software for characterizing oil reservoirs is now available free from the Kansas Geological Survey (KGS), based at the University of Kansas. The software, designed primarily for small, independent companies and consultants, is called GEMINI (for Geo-Engineering Modeling through Internet Informatics). The software was produced over the past three years by a team of

15 Survey scientists, working in collaboration with eight energy companies in a project that received funding from DOE. The software can be accessed at no cost from the KGS web site (www.kgs.ku.edu/Gemini/).

GEMINI consists of eleven integrated software tools and databases that can be used to evaluate the potential of additional oil and gas recovery from a reservoir. Users can conduct analyses on one or multiple wells. GEMINI creates password-protected virtual reservoir analysis projects to examine core data, calibrate and analyze wireline logs, analyze drill stem tests, calculate oil in place, compare oil-in-place calculations with material-balance calculations, and download results for presentation and further analysis in other software. The software tracks user's progress as an aid in reviewing and revisiting a project. On-line step-by-step "Help" functions aid users as they work on a project.

In addition to analyzing company data, and data from the KGS, GEMINI will eventually have the capability to analyze information from other public sites. GEMINI is also being used to convey results of KGS research, serving as platform for distance learning and technology transfer.

For more information, contact KGS's Lynn Watney, phone (785) 864-2184, E-mail lwatney@kgs.ukans.edu. ♦

Conformable Sensor Maps Pipeline Corrosion

A prototype sensor that can quickly and inexpensively measure pitting and deterioration of steel pipelines recently passed a critical test on its path to commercialization. Known as the "conformable array," the sensor provided accurate, automated measurements of corrosion on the exterior of pipes during a recent field test at Southwest Research Institute (SwRI) in San Antonio. SwRI is developing the sensor, in cooperation with Houston's Clock Spring Company and DOE's National Energy Technology Laboratory (NETL).

Traditional technologies use manual measurements. The new sensor is computerized and automated leading to faster, more accurate and less expensive corrosion measurements. The traditional method for detecting pipeline corrosion requires excavation to expose a pitted section of pipe, sandblasting to remove all dirt and debris, then manual measurements by a technician using a hand-held gauge and bridging bar. Time-consuming and expensive, this method is also subject to the technician's interpretation. The new sensor also requires that a pipeline be exposed, but it does not require sandblasting. Because the method is

automated, it eliminates individual interpretation and improves accuracy.

The flexible sensor is about 6 inches square, and designed to conform to the contours of the pipe. Two rigid circuit boards, each about 3 inches by 6 inches, attach to the sensor at opposite ends, making a rectangular unit about 6 inches by 12 inches. Rugged enough for field use, the unit is applied to a pipeline's exterior, and the sensor takes an image of the overlaid area. The unit is then moved, and new images taken, until a picture has been produced of the pipe's circumference. The data is transmitted to a computer in real time. The computer forms a composite image of corrosion from the individual snapshots, and analyzes the extent of the damage. The conformable array was developed as part of DOE's Office of Fossil Energy's Delivery Reliability program, which develops technologies to enhance the reliability of natural gas delivery.

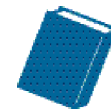
Excerpted from DOE techline (www.fe.doe.gov/news/techlines/03/tl_conformablearray.html). Contact DOE NETL's David Anna, phone (412)-386-4646, E-mail anna@netl.doe.gov, for more information. ♦

Beér Receives DOE's 2003 Lowry Award

DOE recently announced that its 2003 Homer H. Lowry Award will go to Dr. Janós Miklós Beér, a Massachusetts Institute of Technology professor emeritus whose research in combustion science continues to be critical to the design and commercialization of high efficiency, low NOx combustion systems widely used in the fossil fuel power industry. Secretary Abraham will present the award and \$25,000 to Dr. Beér at an awards ceremony in Washington, DC on January 30, 2004.

Dr. Beér's research leading to commercial burners that control the fuel/air ratio and temperature during combustion to minimize NOx emissions while maintaining high combustion efficiency has revolutionized many aspects of the technology. His accomplishments include serving as Dean of Engineering 1973-76 at the University of Sheffield, England and as Director of the Massachusetts Institute of Technology Combustion Research Facility 1976-93. He is currently Professor Emeritus of Chemical and Fuel Engineering at MIT. He is also a member of the National Coal Council.

This is the seventh time DOE has presented the Lowry Award since it was established in 1985. The award is named for Dr. Homer H. Lowry, an internationally known chemist who founded the Carnegie Institute of Technology's Coal Research Laboratories.



DOE invited nominations from the energy industry, academic institutions, and the public in February. A panel of private sector experts from both industry and universities screened nominees, and then a DOE Award Committee reviewed the panel's recommendations and forwarded the name of its recommended candidate to Secretary of Energy Abraham.

Excerpted from DOE Tech Line (www.fe.doe.gov/news/techlines/03/tl_03lowr yaward.html). ♦

DOE's Broad Solicitation for Oil and Gas Technology Development

DOE recently issued a broad solicitation asking for proposals for oil and gas technology development. Proposals in all areas require 20% cost share. They are due February 10, 2004 and must be submitted electronically.

Three areas of interest (Area 1, 2 and 3) are specified for oil-related projects. In these areas, DOE is making about \$12 million of DOE funding available, with about half of that coming in FY04. Fifteen to 22 awards are anticipated within the three areas.

Area 1: Drilling Technology for High Speed Downhole Motors

Area 2: Advanced Diagnostics and Imaging

- Subsurface Imaging
- Regional Study and Basin Analysis
- Reservoir Characterization and Management

Area 3: Reservoir Efficiency Processes

- Chemical Flooding
- Microbial Flooding
- Heavy Oil Recovery
- Novel Processes
- Reservoir Simulation
- Gas Flooding

About \$1.2 million of DOE funding is being made available for gas-related proposals in Area 4. Three to seven awards are anticipated within the four subtopics.

Area 4: Delivery Reliability for Natural Gas

- Inspection Technologies
- Remote Sensing
- Operational Technologies
- Materials Development

Visit Business Solicitation section of DOE NETL's website (www.netl.doe.gov/business/solicit/main.html) for solicitation documents. ♦

Natural Gas Market Centers and Hubs: A 2003 Update

This update by DOE's Energy Information Administration, published in October 2003, looks at the current status of market centers/hubs in today's natural gas marketplace, examining their role and their importance to natural gas shippers, marketers, pipelines and others involved in the production and transportation of natural gas.

View online <http://tonto.eia.doe.gov/FTP-ROOT/features/mkthubs03.pdf>. For further information, contact EIA's James Tobin, phone 202-586-4835, E-mail james.tobin@eia.doe.gov. ♦

Large-Scale CO₂ Sequestration Project at DOE's Teapot Dome Field

DOE's Rocky Mountain Oilfield Testing Center (RMOTC) will manage a large-scale, multiple-partner CO₂ sequestration/enhanced oil recovery project in DOE's Teapot Dome Field. The carbon sequestration potential from the project is projected to be at least 2.6 million tons of CO₂ annually with a concurrent rise in related oil production of about 30,000 Bopd, a six-fold increase over current production level.

This project could grow to be one of the three largest sequestration tests in the world. Conceived with a potential surface area spanning 50 square miles, the test area encompasses industry partner Anadarko Petroleum Corp.'s contiguous Salt Creek oil field. Anadarko plans ultimately to inject about 7,200 tons a day of CO₂ in the Salt Creek field, anticipating more than a six-fold production increase. Anadarko is building a 125-mile CO₂ pipeline from the Shute Creek natural-gas processing plant in western Wyoming. A short spur will deliver CO₂ for injection at Teapot Dome. RMOTC will piggyback Anadarko's Salt Creek effort, in order to minimize government costs. In-kind contributions from Anadarko and others may total about two-thirds of the early costs while the federal government would pay one-third.

The venture is expected to yield important dual assessments, including determination of optimal carbon sequestration levels in depleted oil and gas fields throughout the multi-state Rocky Mountain region, and the optimum combination of sequestration and enhanced oil recovery. The combined Salt Creek and Teapot Dome fields eventually could make up to 33,000 acres available for testing. The full proposal notes that production increases on the federal holding could be

earmarked to defray some costs of government participation.

CO₂ injection would begin about 2006 and continue for seven to 10 years. Project partners to date are RMOTC; Anadarko; The University of Wyoming and its Institute for Energy Research; the University of Maryland; the Colorado School of Mines; iReservoir.com; the University of Colorado-British Petroleum Center for 3-D Visualization; the University of Texas at Dallas; the Lawrence Berkeley National Laboratory; the Lawrence Livermore National Laboratory; the Idaho National Engineering and Environmental Laboratory, and the Los Alamos National Laboratory.

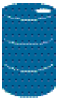
Excerpted from DOE Tech Line (www.fe.doe.gov/news/techlines/03/tl_teapot-dome.html). Contact RMOTC's Doug Tunison, phone (307) 261-5000, E-mail doug.tunison@rmotc.doe.gov, for more information. ♦

UBD Horizontal in California Monterey

Temblor Petroleum Company, LLC is applying balanced/underbalanced drilling (UBD) methods in a horizontal re-entry in a deep (10,000 ft), fractured Monterey-shale play. Maurer Technology Inc., a subsidiary of Noble Corporation, is providing technical assistance for this DOE-supported project. The structure being drilled was originally discovered by a major. Flow tests were uneconomic in the very tight laminated siliceous shale/dolomite reservoir. A subsequent directionally-drilled delineation well exhibited equally disappointing production results after acid fracture stimulation. Further detailed study indicates the play is a very good candidate for horizontals using non-damaging balanced/UBD well construction techniques.

Current plans are to commence re-entry drilling in April 2004. Synthetic oil-base mud and top-drive rig capability will be employed in the long curved section to help mitigate the significant well construction problems in problematic shale overlying the Monterey objective that were experienced in the first two wells. Pre-drilling studies have confirmed static reservoir pressure levels for optimized UBD operational design. Detailed cuttings analysis and core correlation, chromatograph monitoring and gamma-ray LWD will be employed to help geosteer the horizontal section to maximize access to sweet spots and natural fractures.

For more information, contact DOE's Virginia Weyland, phone 918-699-2041, E-mail Virginia.Weyland@netl.doe.gov. ♦



Solutions from the Field: Online Technologies to Solve Problems Faced by Independent Producers

Summaries of regional workshops recently sponsored or co-sponsored by PTTC are added to its national web site regularly. For more complete summaries, and for a listing of the hundreds of workshops that PTTC has sponsored since 1995, logon to: www.pttc.org. For more details, contact 1-888-THE-PTTC, e-mail: hq@pttc.org.

Managing Upstream Oil & Gas Producing Assets

*September 17, 2003 (Baton Rouge, LA)
sponsored by PTTC's Central Gulf Region*

BOTTOM LINE

Upstream oil and gas assets must be managed using an integrated, cradle-to-grave plan to optimize efficiency and maximize profits. The life of a field must be guided by a clearly defined scope of work, a detailed project execution plan capable of handling all contingencies, and a planned ability to manage change. Large old fields that are in decline are often excellent candidates for a field optimization study that will examine the total field production operations with the objective of improving profitability through identifying opportunities for increased production, decreased costs, and improved water management strategies. Using integrated workstation data collection and economics tools throughout the lifecycle of a field can ease management problems by turning decisions into desktop exercises.

PROBLEM ADDRESSED

Upstream oil and gas assets must be managed in order to optimize project efficiency and profitability. Integration must be built into the three necessary aspects of project management, which are: a clearly defined scope, a project execution plan (PEP) and ability to manage change. A scope statement defines the job and will therefore help to keep costs low and minimize schedule duration. The PEP defines how the job should be accomplished and must include contingencies for all project activities. Because change can be good or bad, depending on how it is managed, the ability to manage change must be built into projects from the beginning.

One way to know whether any project can be improved is to create a snapshot of before and after conditions. This is done by a Field Optimization Study (FOS). Previously conducted FOS studies indicate that improvement of production facility operations can lead to increased production, more efficient produced water handling and realization of significant profits. The best candidates for

these studies are large or complex mature fields where more than 75% of the recoverable reserves have already been produced, present production is less than 25% of peak production and minimal workovers have occurred. Potential improvement through FOS is typically 4-6% for production and 20-22% for costs. ♦

Applied Geology for the Petroleum Engineer

*August 20, 2003 (Norman, OK)
co-sponsored by PTTC's South Midcontinent Region and the Oklahoma Geological Survey*

BOTTOM LINE

Compartmentalization within sandstone reservoirs is chiefly related to several scales of geological complexity. The most important scales include those determined by the depositional setting and the resultant facies architecture, mud content and shale distribution, and grain size trends. Porosity and permeability are often correlated with grain size in sandstone reservoirs. Many of the geological complexities in sandstone reservoirs are smaller than seismic scale ('sub-seismic') and must be defined by log, outcrop, and/or core-based studies. Integrated geological-engineering models for the reservoir can be optimized when the causes of compartmentalization are understood.

PROBLEM ADDRESSED

This short course presented applied geological principles for petroleum engineers. Emphasis was on characterization of sandstone reservoirs, compartmentalization, and its effects on reservoir performance. In order for petroleum engineers to maximize production and to optimize reservoir management of sandstone reservoirs, it is important to understand reservoir architecture and the geological causes of compartmentalization in fluvial, eolian, shoreface, barrier island, deltaic and deepwater reservoir settings. Features critical to reservoir development include several scales of geological properties including depositional setting, facies stacking patterns, lateral and vertical variations in lithology and grain size, sandstone continuity and depositional architecture, effect of bounding sur-

faces and petrophysical properties. Many of these aspects are beneath seismic resolution or detection. For this reason, detailed outcrop, log and core-based geological studies can provide important constraints that should be incorporated into reservoir models by petroleum engineers. ♦

AVO Seismic Technology

*October 9, 2003 in (Jackson, MS)
sponsored by PTTC's Eastern Gulf Region*

BOTTOM LINE

The amplitude variations with offset (AVO) technology was introduced over 20 years ago. In the intervening years, the technique has evolved from a concept to a primary component of seismic exploration. AVO methods can add reliable constraints to quantitative reservoir characterization if the operator understands the underlying concepts and how to apply the technology.

PROBLEM ADDRESSED

The workshop presentation and notes give an overview of AVO technology methodology and help to define some of the complex issues involved with using the technology. Examples and case studies are included to show the relevance of the technology. The basics of rock physics and current trends in inversion technology are included in the discussion to enhance practical application of AVO. ♦

American Oil and Gas Reporter Tech Connection Column

December

Small Operators Finding Profitable Applications Of Seismic Technology

November

Denver Group Makes Simulation Available To The World

October

New Mexico Tech Evaluates The Effectiveness of "Fuzzy Logic" Tool



4th Quarter 2003 Case Studies Petroleum Technology Digest

Integrated Rod-Pump Controller Cuts Operating Costs

Bottom Line: Phoenix Hydrocarbons Operating Co. beta-tested the new iBEAM rod-pump controller (RPC) on a well near Dayton, Texas. The field has 120 rod-pumped wells lifting fluids from depths of 2,000 to 4,000 ft. Sixty wells use timers. The test well produces 6 bopd with 50% water from 2,300 ft. Prior to installing the RPC, a timer set by the operator controlled the well, which pumped 12 hr/day. Using the RPC, which has been on the well seven months, pumping time has been reduced to only 3 hr/day without decreasing production. This saves about \$125/month in power costs, which alone will pay out the RPC installation in less than 16 months. Additional future savings are expected from reducing the number of repairs and workovers, as has been documented in other installations.

Gravel Packing Through The Shoe Saves Horizontal Openhole Job

Bottom Line: A conventional, top-down gravel pack was planned in a recent, horizontally drilled well at California's Wilmington field. When the job prematurely packed off at the top of the liner, the operator, Tidelands Oil Production Co., was left with a difficult decision. The firm could attempt to fish the liner

and start over, try producing the well as is, or hope to place additional gravel through the shoe. Most operators will not attempt to pack through the shoe, for fear of becoming stuck. The job was completed by gravel packing through the shoe, salvaging what otherwise would have been an unsuccessful completion. The well has produced 20 months, with current output averaging 180 bfpd, without sand problems.

Characterization, 3-D Visualization Spur Offshore Redevelopment

Bottom Line: At South Ellwood field in the Santa Barbara Channel, offshore Southern California, Venoco Inc. employed advanced reservoir characterization technologies to identify redevelopment options. The first of three planned development wells accessed a previously undrained fault block, producing more than 800 bopd and 2 MMcf/d upon initial completion. A five-well, through-tubing plugback program, based on data from new-generation production logs and considering the new geological understanding, has increased production by 600 bopd and reserves by 6 million bbls. Two newly defined, fault block structures, primarily identified by seismic reprocessing, should be drilled during 2004. Reserve potential there could exceed 60 million bbls. ♦

Petroleum Technology Digest is a joint project of Gulf Publishing (*World Oil*) and PTTC. See case studies online at www.pttc.org/case_studies/case_studies.htm. Contact lcoble@pttc.org.

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<http://octane.nmt.edu/sw-pttc>

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<http://wst023.west.wmich.edu/pttc.htm>

Permian Basin
Bob Kiker
432-552-3432
www.energyconnect.com/pttc/pb/

Alerts Via E-Mail: Another PTTC Service

	PTTC Highlight	Industry Highlight	DOE Highlight
Dec. 17	Live Webcast From California, Economic Optimization in Marginal Fields	New Filter for Low-Pressure Sour Gas	Proposals for DOE's Broad-Based O&G R&D Solicitation Due Feb. 10, 2004
Nov. 25	Online Database on Kansas Gelled Polymer Production-Side Treatments	Industry Reports Address Oilfield Market For Technology Providers	Recently Formed CO ₂ Sequestration Partnerships Begin Working
Nov. 6	Technologies for Mature Oil and Gas Wells, Casing Drilling	A Seismic Twist	Oil Well Stability in Gulf of Mexico
Oct. 9	Technologies That Impact The Bottom Line	OERB Approaching 5,000th Abandoned O&G Site Cleanup Milestone	Microhole Technology Development Proposals Sought

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PTTC North Midcontinent TECH FAIR 2004

March 24, 2004
Wichita Hilton, Wichita, Kansas

Presentations and an exhibit area featuring technologies appropriate for the Midcontinent. Among others, technologies include:

- ✓ Nitrogen rejection units to improve gas quality in low-BTU gas production
- ✓ Identifying and quantifying gas in coalbeds, while drilling
- ✓ Improved flow characteristics utilizing vortex flow methods
- ✓ Remote (field) data collection and utilization
- ✓ Highly-efficient, economical, pump-off controllers
- ✓ Pacemaker™ plunger-lift methods
- ✓ Poly-lined tubing for reducing downhole failures
- ✓ Latest oilfield chemical applications

Call PTTC North Midcontinent
(785-864-7398) for further information.

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For more information: Sandra Mark,
smark.95@alum.mines.edu, 303.273.3107



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. Please note that some topics, dates, and locations listed are subject to change.

January 2004

- Jan & Feb Rocky Mountain: *Low Cost Software and Data Fair* (virtual exhibit hall at www.pttrockies.org). Learn about software, sign up for workshops in Golden, CO.
- 1/7 South Midcontinent: *Basics of Gas Quality and Gas Processing* (Marginal Well Commission) - Woodward, OK.
Contact: 405-604-0460
- 1/8 South Midcontinent: *Basics of Gas Quality and Gas Processing* (Marginal Well Commission) - Ada, OK.
Contact: 405-604-0460
- 1/14 South Midcontinent: *Basics of Gas Quality and Gas Processing* (Marginal Well Commission) - Tulsa, OK.
Contact: 405-604-0460
- 1/14 Rocky Mountain: *GeoPlus PETRA Basic Training* - Golden, CO. Contact: 303-273-3107
- 1/15 Texas: *Integrated Synthesis of Permian Basin Depositional Systems* (Texas BEG) - Midland, TX. Contact: 512-471-0320
- 1/15 South Midcontinent: *Basics of Gas Quality and Gas Processing* (Marginal Well Commission) - Oklahoma City, OK.
Contact: 405-604-0460
- 1/16 Rocky Mountain: *CoreDraw Graphics for Cross Sections* - Denver, CO. Contact: 303-273-3107
- 1/21 Texas/Central Gulf: *Soil Remediation* - Tyler, TX. Contact: 512-471-0320 or 225-578-4542
- 1/29 West Coast: *A Diatomite Workshop* - Valencia, CA. Contact: 213-740-8076
- 1/29 Midwest: *How To Use The ISGS Internet Mapping Service (IMS) and Preview of Illinois Basin Pay-Map Series* - Mt. Vernon, IL. Contact: 217-244-9337

February 2004

- 2/3 Central Gulf: *Application of Logging Tools For Improving Reservoir Interpretation* - Baton Rouge, LA. Contact: 225-578-4542
- 2/3 South Midcontinent: *Asphaltene and Paraffin Problems* (Marginal Well Commission) - Wichita Falls, TX.
Contact: 405-604-0460
- 2/4 South Midcontinent: *Asphaltene and Paraffin Problems* (Marginal Well Commission) - Oklahoma City, OK.
Contact: 405-604-0460
- 2/10 South Midcontinent: *Asphaltene and Paraffin Problems* (Marginal Well Commission) - Tulsa, OK. Contact: 405-604-0460
- 2/11 South Midcontinent: *Asphaltene and Paraffin Problems* (Marginal Well Commission) - Pawhuska, OK. Contact: 405-604-0460
- 2/11 Rocky Mountain: *Well File 5 Data, Mapping, Cross Sections, Productions Charts More* - Golden, CO. Contact: 303-273-3107
- 2/17 Rocky Mountain: *Surfer 8 Contouring, Gridding & Surface Mapping* - Golden, CO. Contact: 303-273-3107
- 2/19 Rocky Mountain: *Jlog Petrophysics, Wireline Log Analysis* - Golden, CO. Contact: 303-273-3107
- 2/24 North Midcontinent: *Case Studies of the Exploitation of a Mature Reservoir in Kansas Through Technology Application* - Wichita, KS. Contact: 785-864-7398
- 2/25 Rocky Mountain: *DOE Neuro3 Neural Network Software* - Golden, CO. Contact: 303-273-3107
- 2/25 Rocky Mountain: *DOE Boast Black Oil Simulator* - Golden, CO. Contact: 303-273-3107
- 2/25 North Midcontinent: *Case Studies of the Exploitation of a Mature Reservoir in Kansas Through Technology Application* - Hays, KS. Contact: 785-864-7398
- 2/26 West Coast: *Fracturing Stimulation For California Oilfields* - Valencia, CA. Contact: 213-740-8076

March 2004

- 3/2 South Midcontinent: *Oil and Gas Measurement Problems* (Marginal Well Commission) - Enid, OK. Contact: 405-604-0460
- 3/3 Midwest: *Produced Water and Associated Issues* - Evansville, IN. Contact: 217-244-9337
- 3/4 Midwest: *PUMP II Deliverables, Illinois Pay-Map Series and IMS* - Evansville, IN. Contact: 217-244-9337
- 3/9 South Midcontinent: *Oil and Gas Measurement Problems* (Marginal Well Commission) - Ada, OK. Contact: 405-604-0460
- 3/9-10 Rocky Mountain: *GeoPlus PETRA Basic Training* - Golden, CO. Contact: 303-273-3107
- 3/9-10 South Midcontinent: *Unconventional Energy Resources in the Southern Midcontinent* (Oklahoma Geological Survey) - Oklahoma City, OK. Contact: 405-325-3031
- 3/12 North Midcontinent: *Reading The Rocks From Wireline Logs* (Kansas Geological Survey) - Lawrence, KS. Contact: 785-864-7398
- 3/16 South Midcontinent: *Oil and Gas Measurement Problems* (Marginal Well Commission) - Tulsa, OK. Contact: 405-604-0460
- 3/19 Midwest: *Michigan Field Experiences, Focus on the Niagaran* (N. Michigan SPE) - Mt. Pleasant, MI.
Contact: 269-387-8633
- 3/23 South Midcontinent: *Oil and Gas Measurement Problems* (Marginal Well Commission) - Oklahoma City, OK.
Contact: 405-604-0460
- 3/23-24 Rocky Mountain: *Seismic Micro-Technology Kingdom Suite* - Golden, CO. Contact: 303-273-3107
- 3/24 North Midcontinent: *Petroleum Technology Fair* - Wichita, KS. Contact: 785-864-7398
- 3/30-31 Rocky Mountain: *Petcom PowerLog* - Golden, CO. Contact: 303-273-3107
- 3/31 Midwest: *Desktop Mapping; More Bang For The Buck From Your Well Data* - Mt. Vernon, IL. Contact: 217-244-9337

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Interested in participating at the regional level? Call 1-888-THE PTTC

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