PROGRAM facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Strategic Center for Natural Gas and Oil

06/2005

OIL EXPLORATION & PRODUCTION PROGRAM DRILLING, COMPLETION AND STIMULATION

Background

U.S. oil fields are depleting rapidly while replacement fields are found increasingly in remote regions where drilling for and producing oil can be environmentally or politically prohibitive, economically unjustified, or technically impossible with current practices. Hundreds of known U.S. shallow (<5,000 feet) oil fields have been produced for most of a century and now have very low oil production rates. They still contain an estimated 218 billion barrels of oil, but many fields cannot continue to be produced economically primarily due to their low production rates and comparatively high access costs. Drilling technologies that are low-cost and easily transportable and that have minimal environmental impact are needed to capitalize on the large remaining domestic resource.

Description

The Oil Drilling, Completion, and Stimulation (DCS) Program develops tools and techniques to reduce drilling costs, improve well productivity, and reduce environmental impacts of accessing oil. The program includes the areas of microhole technology (which is covered in detail in its own Program Fact Sheet), novel completion techniques, advanced stimulation technologies, gas-liquids separation, well integrity modeling, cuttings transport studies, and ultra-high-speed drilling.

The goals of this program are to assist industry to develop technologies that can be used in diverse geologic settings, reduce costs, increase exploration success, minimize formation damage, guard against environmental damage, and improve well productivity.

Benefits

Benefits from this program include lower drilling and operating costs, reduced formation damage caused by drilling and completion fluids, advanced fluids and solids separation technology, and optimized reservoir drilling, development, and production operations.

DOE estimated the benefits from the oil DCS programs dating from 1978 to 2005 at $2.2 billion. In its 2001 report assessing the value of DOE's oil and gas R&D programs, the National Research Council said that while it could not verify the basis for DOE's assessment of benefits, "…it is certainly obvious that DOE has made a contribution well in excess of its outlay."

NPC cited the program for making important contributions to the development of polycrystalline diamond compact (PDC) bits, horizontal drilling, slimhole and coiled tubing drilling, synthetic drilling fluids, and cuttings injection. The council also cited the program's significant environmental benefits, such as smaller footprints, reduced noise, lower toxicity of discharges, reduced fuel use, and better protection of sensitive environments.

CONTACTS

Margaret Lou
Director
Office of Petroleum
918-699-2015
margaret.lou@netl.doe.gov

Jerry Casteel
Director
Petroleum Technology
Management Division
918-699-2042
jerry.casteel@netl.doe.gov

Roy Long
Technology Manager
Oil Exploration and Production
918-699-2017
roy.long@netl.doe.gov

ADDRESSES

National Energy Technology Laboratory

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

One West Third Street
Suite 1400
Tulsa, OK 74103-3519

CUSTOMER SERVICE

1-800-553-7681

Information about our programs can be found at:

www.netl.doe.gov

Accomplishments

This program has had a distinguished past in funding the development of new technologies that are used throughout the petroleum industry today. Its history goes back to the federal drilling research program initiated in 1975 following the Arab oil embargo.

Some early examples are:

- Teleco developed the first system to transmit drillbit location data to the surface by sending pressure pulses through drilling muds. Although this work was done in the 1970's, today mud-pulse telemetry is the industry standard.

- General Electric working with Sandia National Laboratories developed and demonstrated the first PDC drillbit. In 1986 a revolutionary bonding technique developed by Sandia helped make PDC drillbits commercially viable.

Among the more recent projects are the following:

- *Testing of Sonic Stimulation Technology/Michigan Tech University/15165*. Sonic stimulation is an emerging technology that has been used to enhance oil field production. Michigan Technological University is performing field tests to increase the knowledge and understanding of how sonic stimulation works in enhancing oil output.

- *Cavity-like completions/Texas A&M/15275*. Oil and gas production from loosly packed sand formations often carries sand grains that erode production piping and plug processing equipment. Current solutions to sand production are either expensive or they impede hydrocarbon production. Texas A&M is exploring a technique of oil and gas production wherein a cavity is created near the wellbore and the well is flowed at an absolute maximum rate long enough to produce loose sand near the well. From then on the well is flowed at rates less than the maximum with little or no incidental sand. The project will deliver guidelines for cavity-like completions based on a battery of field tests.

- *Well integrity modeling for Deepwater Gulf of Mexico subsalt fields/Sandia National Lab*. Access to deepwater Gulf of Mexico oil is complicated by huge salt formations, sometimes thousands of feet thick, that overlie the oil. Salt movement can cause failure in well casing, resulting in the total loss of some wells costing as much as $50 million each. Sandia National Laboratory and industry partners are studying the timing and magnitude of salt forces on well casings and developing safer, more-efficient casing designs.

- *Advanced Cuttings Transport Facility/University of Tulsa/15178*. Remedial operations to free stuck drillpipe can cost upwards of $400,000 daily. Stuck drillpipe is often the result of inadequate transport of drilling cuttings out of the hole. The University of Tulsa and industry partners have developed the Advanced Cuttings Transport Facility at the University of Tulsa campus. The goal of the industry project is to prevent stuck drillpipe by studying the removal of rock chips and cuttings from a well.

- *Feasibility of Ultra-High-Speed Diamond Drilling/TerraTek/15401*. Industry's operational "footprint" has been greatly reduced with the advent of directional and horizontal drilling, which allows significant consolidation of wells at a single onshore drillsite or offshore platform rather than relying on multiple individual drillsites. Directional and horizontal drilling will be enhanced by increasing drillbit speed. DOE, TerraTek, and industry partners are researching and developing ultra-high-speed drillbits to assist in directional and horizontal well drilling.