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 RESERVOIR DESCRIPTION AND DYNAMICS

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

Background

New technologies are required to ensure a longer-term economic supply of domestic oil needed to meet America's demand that EIA projected at more than 40 billion barrels of oil by 2015. Activities in this area are important to find and develop an undiscovered domestic resource base that the U.S. Geological Survey and Minerals Management Service estimated at 60-100 billion barrels of oil.

With better diagnostic and imaging technologies, producers can "see" oil, gas, and associated rocks from the earth's surface and nearby wellbores. Visualizing the barriers and pathways for subsurface fluid flow allows expensive wells and enhanced-production projects to be more efficiently positioned, thereby reducing risk, cutting costs, and increasing ultimate recovery.

New imaging technologies have contributed significantly to improved drilling success. For example, 3-D seismic imaging, today's leading imaging technology, has been a major contributor to the revitalization of operations in the Gulf of Mexico, where oil production increased by 50% during 1995-2000. Seismic imaging technologies have prevented numerous dry holes. Typical savings from elimination of a single subsalt dry hole in the Gulf of Mexico are estimated at $12 million.

Description

In alliance with the oil and gas industry, DOE is supporting research, development, and deployment of advanced diagnostics and imaging techniques, combining the best public and private capabilities to accelerate the creation and implementation of promising, innovative approaches. Advanced diagnostics and imaging systems are being developed to improve the success rates and cost efficiencies for finding new fields and developing producing ones.

The Reservoir Description and Dynamics program targets technology developments in seismic and other imaging technologies, geologic modeling tools, and reservoir characterization and modeling that are designed to solve problems and reduce uncertainties across the entire range of exploration, development, and production operations.

The goal is to provide a refined picture of underground resources and their environments that will enable fewer dry holes, better use of natural phenomena such as fractures, and development of more effective well patterns to increase oil recovery and lower environmental impact.

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

Acccomplishments

NETL's Reservoir Description and Dynamics Program can boast a number of technology breakthroughs in the last 10 years, among them the following:

- One of the first demonstrations of 4-D seismic was conducted in 1994 by Columbia University in Eugene Block Island field in the Gulf of Mexico. This project imaged oil migration into the reservoir. Growing acceptance of 4-D seismic as a tool for monitoring subsurface fluid flow and reservoir behavior shows the potential for the kind of revolutionary impact that 3-D seismic had on the industry in the 1990s.

- Los Alamos National Laboratory along with OYO Geospace in 1997 conducted pioneering work and application of borehole seismic instrumentation packages combining geophones and a class of sensors called MEMS (microelectromechanical) systems to image the fractures in Opelika Field, AL. The technology was subsequently commercialized and is widely used in industry today.

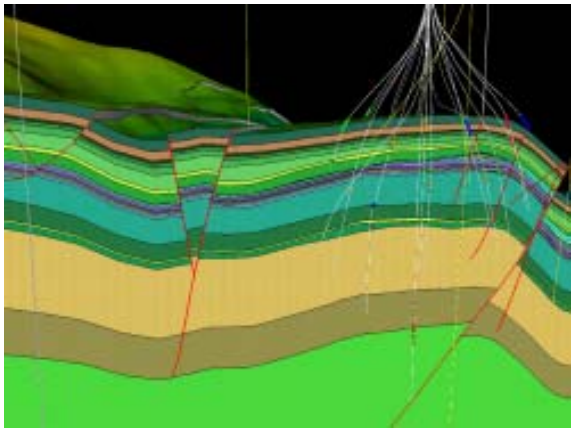
- ParaMagnetic Logging Inc. with partners designed and constructed the first inductive logging device to measure formation resistivity through a steel-cased borehole. A total of 27 U.S. and foreign patents resulted from this work. The technology was commercialized in 1999.

- Virginia Tech developed optical fiber sensors for monitoring pressure, temperature, oil flow, and acoustic waves in oil wells and field-tested the technology in a Coalinga, CA, oilfield in 1998. This breakthrough in fiber optics telemetry technology marks a key milestone in industry's long quest to develop cost-effective, reliable fiber sensors optimized for rugged downhole applications. None of the sensors in the field tests has failed to date, and the data they transmit still are being collected via the Internet today.

Benefits

Imaging technologies research enables industry to develop better techniques for creating and visualizing data to locate and produce petroleum reserves.

On the exploration side, advances in imaging technologies help operators develop techniques for finding hydrocarbons in complex geological settings such as fractured reservoirs, salt structures, and deep wells. The Nation's vast resource of bypassed, or "stranded," oil is more readily located by combining seismic and electromagnetic techniques. In addition, operators are able to drill strategically targeted wells to intersect multi-component reservoirs, thereby reducing exploratory and development risk. In such instances, reservoir compartments can be identified from production history, detailed well-log cross sections, and 3-D seismic.



Venoco Oil Company used reprocessed 1982 seismic data with modern algorithm computer software technology to identify three new geologic structures partially outside the company's current project area in the Santa Barbara Channel, where California law prohibits new seismic surveys.

Imaging technology advances also help operators increase oil production and ultimate reserves recovery. Producers can use new interwell imaging tools such as crosswell seismic and vertical seismic profiling to enhance their understanding of reservoirs in an effort to redevelop mature fields. Operators also are able to better characterize and manage reservoirs with improved simulation techniques and reservoir models, thus increasing oil recovery.