OFFICE OF FOSSIL ENERGY

2008 SUMMER NEWS

ROCKY MOUNTAIN OILFIELD TESTING CENTER

PROJECT SUMMARY

TECHNOLOGIES TESTED AT NPR-3 VARY WIDELY

As the federal government's only operating oilfield, Naval Petroleum Reserve No. 3 (NPR-3) is a meeting ground for industry to partner with government in research, testing, demonstration, and deployment of new technologies across the country and world. As a production facility with its primary mission being research and development, RMOTC's capabilities run the gamut. The following is a partial list of recent and current RMOTC projects.

PROJECT	DESCRIPTION
Rotary Steerable Tool	Determine directional performance of both push-the-bit and point-the-bit rotary steerable drilling systems.
Gas Leak Detection	Test the client's Airborne Laser Methane Assessment (ALMA) system's ability to detect methane content and volume under simulated pipeline leak conditions.
Stirling Generator	Determine the reliability of a Stirling generator in a remote location to run artificial lift equipment using raw natural gas in cold weather.
Geothermal Power	Test a binary geothermal power generation system using hot, produced oilfield water from the Tensleep and Madison formations. The project will test the use of waste heat from produced water to generate power to operate an oilfield (See Page 4).
Solar Powered Pump System	Install and operate a fluid shipping pump with DC motor powered by solar panel array.
Rotary Gas Separator	Test rotary gas separator on submersible pump intake under actual production conditions. The separator is designed to separate methane from water in a coalbed methane production operation.
Wellbore Paraffin-Asphaltene Treatment	Evaluate the effectiveness of proprietary product in cleaning out wellbore and near wellbore.
Submersible Pumping System	Field test low-volume, high-efficiency submersible pumps.
Surfactant EOR Flood	Conduct a pilot project to determine economic and technical feasibility of a surfactant enhanced oil recovery flood in NPR-3's Shannon reservoir.
In-Situ Gas Extraction	Test gas bubble formation and flow dynamics of in-situ gas extraction technology; then test EOR capability of this technology.
Airborne Survey	Acquire field-wide survey to test effectiveness of cathodic production systems, locate steel-cased wells, and determine background atmospheric concentrations of CH4, CO2, and total C1-5 hydrocarbons.
Wind Turbine Test Center	Install small wind turbine at NPR-3 as a pilot study.

RIG UPGRADES

RMOTC'S EQUIPMENT TO SEE MANY UPDATES THIS SUMMER

As the oil and gas industry continues to drill in more remote areas, at deeper depths, and in more challenging environments, the advancement of oil and gas related technology to meet these increased demands is required. In response, RMOTC has committed a significant portion of its budget to upgrade several items on its existing drilling rig at Naval Petroleum Reserve No. 3 (NPR-3). Current RMOTC rig specs can be found at www.rmotc.doe.gov.

The rig upgrades will be in place by August 2008 and include the following:

- **Mud tanks with agitators**
  A new 800-barrel system capable of handling up to 1,500 GPM will be installed.

- **Shale shakers and mud cleaners**
  The new system will keep drilling mud clean and the mud weight consistent throughout drilling.

- **Upgrade generators**
  The new shale shakers and mud cleaners require more power, therefore the generators will be upgraded to meet the demand.

- **Upgrade pumps**
  Upgrades to the Gardner Denver 2250, a new 7" fluid end, will allow pump rates up to 650 GPM. Belts on the OPI pump will also be changed to achieve better efficiency.

- **Heavyweight drill pipe (HWDP)**
  RMOTC will purchase 600 feet of 5" HWDP, especially useful for rotary steerable system (RSS) testing.

- **Pipe spinners**
  These smaller, lighter spinners will result in increased safety as they are more manageable by rig personnel.

THE POWER OF WASTE WATER

RMOTC PROJECT TO USE PRODUCED WATER FOR GEOTHERMAL APPLICATION

There are a large number of oil and gas wells in the United States that produce hot water as well as hydrocarbon products. These wells, which generally produce fluids at temperatures below 220°F, have been estimated as being capable of generating upwards of 5,000 MW of power. To test the concept of using oil-field waste water to power field production equipment, RMOTC recently partnered with Ormat Nevada Inc. Equipment for the test will be installed this summer at NPR-3.

The purpose of the project is to validate the premise that a binary geothermal power generation system that uses hot water produced by an oil field can reliably generate commercial electricity. The unit to be used is similar to the 250 kW Ormat Energy Converter (OEC) unit that has been producing electricity from 210°F geothermal water at an Austrian resort for more than six years. Similar units have also been in continuous commercial operation since the 1980s in Nevada and Thailand.

The power system is a commercial, air-cooled, skid-mounted standard design Ormat Organic Rankine Cycle (ORC) power plant. Ormat will supply the unit that RMOTC will install and subsequently operate for a 12-month test period – together about a $1 million investment. The binary power unit brings produced hot water through pipelines to a heat exchanger in the OEC. In the heat exchanger, the geothermal fluid heats and vaporizes a secondary working fluid, which is typically an organic fluid with a low boiling point. **The vapors drive a turbine which powers a generator and then are condensed for recycle into the heat exchanger, completing the cycle within a closed system.** The cooled geothermal fluid is reinjected into the reservoir or discharged.

Geothermal Potential at NPR-3

Two formations at NPR-3 produce sufficient hot water for the generation of low-temperature geothermal energy. The average production temperature for the Tensleep is 190°F and 200°F for the Madison. Early projections indicate that with minor work on

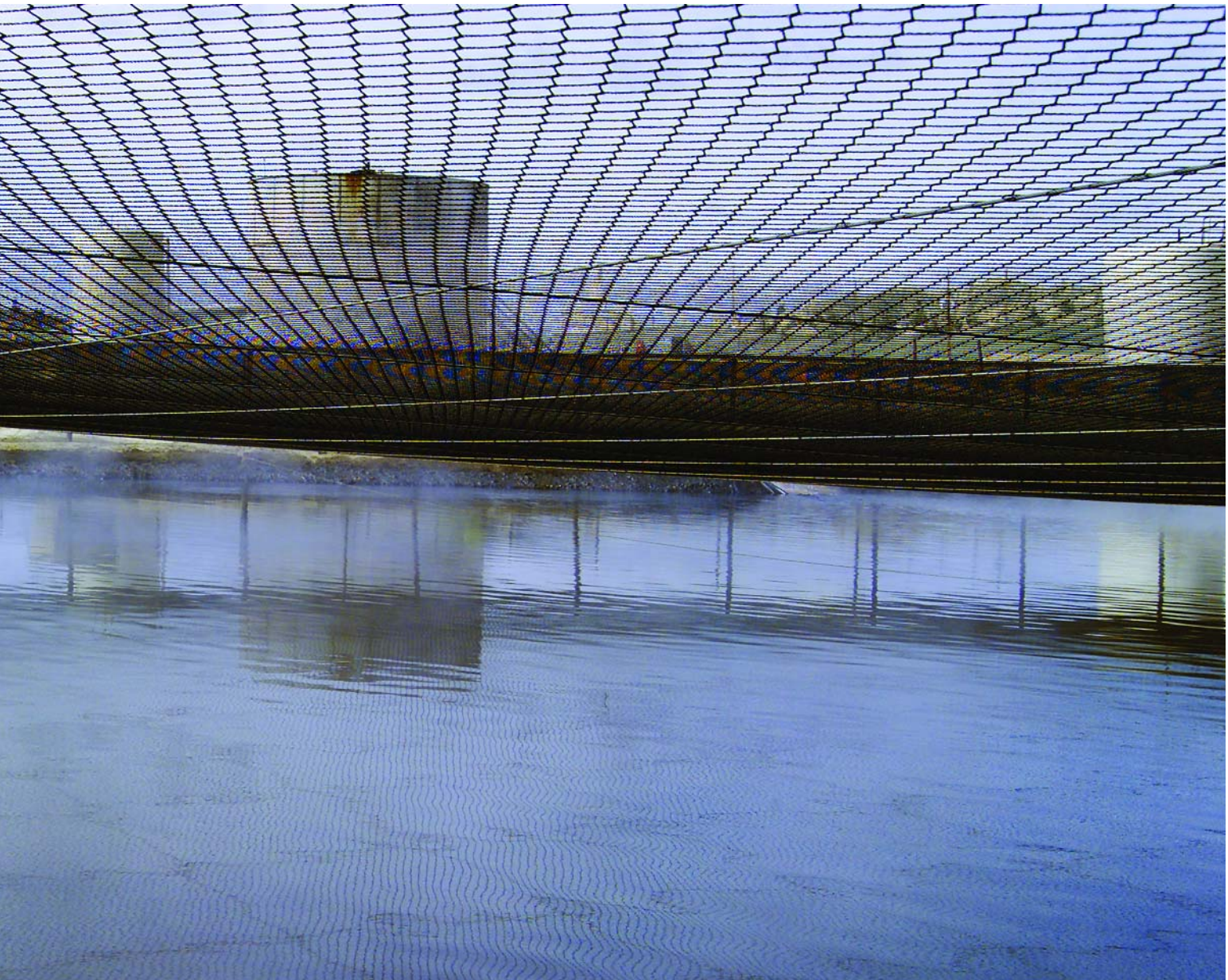
Left: The equipment to be installed at NPR-3 is set to arrive in mid-June. Below: Waste water at NPR-3 is currently treated before being discharged into an adjacent stream.

present wells, the rate for the combined Tensleep and Madison produced water would be between 126 and 210 MBWPD. There is also the potential to drill additional Tensleep and Madison wells.

The present produced water from the Tensleep formation is projected to produce 180 kW of gross power. When the Madison produced water is included with potential increases in Tensleep production, the gross power potential would be in the 540 kW to 900 kW range. Currently, the hot water is a waste stream and is treated through a series of treatment ponds and then discharged into an adjacent stream. The OEC will allow the water's heat to be harnessed before it reaches the ponds. The electricity generated from the Tensleep wells' produced water will be used to power field production equipment. The ORC power unit will be interconnected into the field electrical system and the produced energy will be metered and monitored for reliability and quality.

The aquifer in both the Tensleep and Madison formations are continuously recharged from the mountains to the west. The Tensleep and Madison are interconnected by a series of fractures to the underlying formations and the basement rock. **The unit that will be used at RMOTC has been field proven in other situations, but has never been used in an oil field.**

Harnessing the available hot water produced during oil production to power the oil field could potentially lead to more economical access to reserves, especially in stripper fields such as NPR-3. The use of field-proven and time-tested technologies to test geothermal application in the oil field builds confidence that this clean, renewable source could become commonplace in the oil fields of the future.



GIS EXPANDS ROLE

RMOTC DEMONSTRATES PROGRAM'S 3D CAPABILITY

In recent years, RMOTC has worked on the implementation of a geographic information system (GIS). Today, RMOTC's GIS software maps 1,350 well bores ranging in depth from approximately 250 to 7,000 feet and includes data on producing, non-producing, and new well drilling opportunities. GIS is also being used for some not-so-common applications at RMOTC.

Since 2006, RMOTC has been using ESRI's ArcGIS software as its primary field mapping system. The software stores and processes information used for numerous oil field applications such as creating base maps of field infrastructure and facilities, displaying well production data, incorporating geological and geophysical interpretations, monitoring environmental requirements, tracking oil field operations, and much more.

Non-proprietary GIS data available

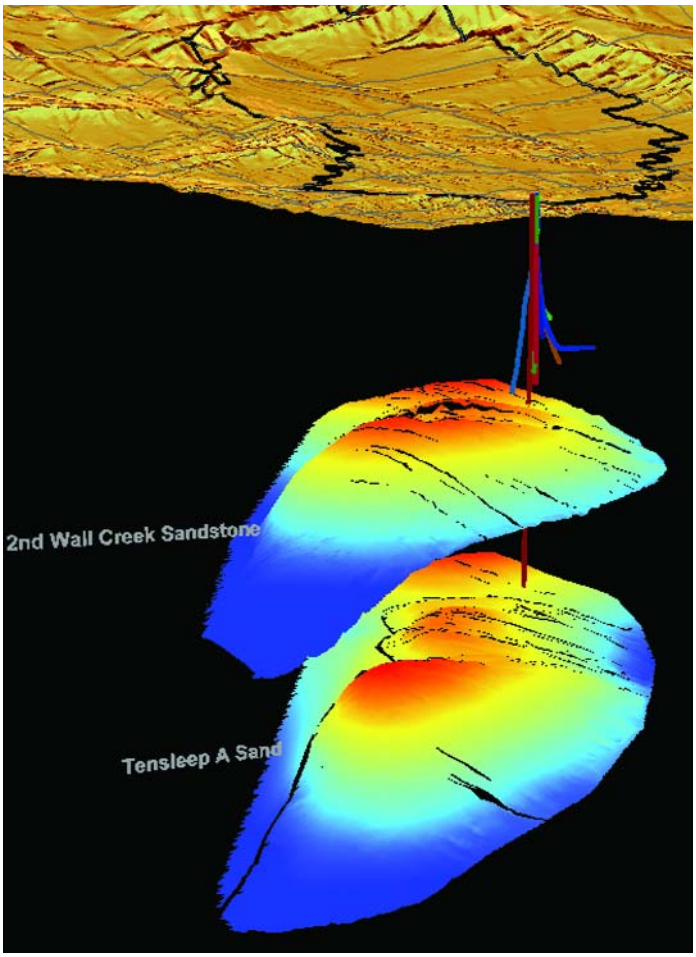
RMOTC recently added a GIS data set to its library of nonproprietary data. The data includes NPR-3 field data, geology, pipelines, quadrangles, subsurface structures, and images. Well, seismic, and core data sets are also available. For more information or to request data, call RMOTC. Some conditions apply.

Expanded use

RMOTC has also demonstrated how GIS can be used to manage operating costs and increase revenues. It determines the optimized use of well production units and assesses gas gathering systems. The GIS user can put a 1.5-mile buffer around wells that are top producers to determine areas on which operators should be focusing their attention. Then a layer of the gas flowlines data is overlaid and nodal analysis is performed to identify where improvements can be made to the routing, pipeline sizing, boosters, and compressor stations.

Even the efficiency of drilling tools can be assessed with GIS. RMOTC has several partners that use its drilling rigs to test rotary steerable drilling tools. Using ArcGIS to plot the down-hole well surveys and ArcGIS 3DAnalyst to calculate "z" coordinates and create 3D maps (see above right), **engineers are now able to show a cut surface of the test well location and see well path deviations caused by the drilling tool.** GIS provides a worm's-eye view of the hole from the surface digital elevation model (DEM) down through the subsurface, to the well bottom.

Remote sensing data can also be input into the GIS to create visualizations of play area features. For example, RMOTC used GIS to study natural magnetic anomalies detected by sensors mounted on booms suspended from a helicopter. Oil and gas wells modify



ArcGIS Analyst depicts 3D subsurface of test well. Data layer provides worm's-eye view of the surface digital elevation model (DEM).

the earth's magnetic field to generate their own peculiar magnetic signatures, but other magnetic oddities were showing up in the sensing data. The captured anomaly data was added as a data layer in the GIS. By combining this with additional layers showing facilities and other ground attributes, staff was able to depict the source of magnetic occurrences created by high concentrations of iron and metal. These included wells, the gas plant, the pipe yard, a tank battery, a bridge, and a pump jack storage area. Some anomalies were not readily identified from the database, suggesting that a well had gone undocumented or had been inaccurately plotted.

Looking ahead

As its GIS capabilities continue to develop, RMOTC is working on a comprehensive geodatabase that incorporates well locations, production data, well history, open and case hole logs, core data, facility information, and images. All of these data will be hyperlinked to a location on an interactive map hosted on the RMOTC website.

SENATOR VISIT

NEWEST MEMBER OF THE WYOMING DELEGATION VISITS RMOTC

RMOTC Director Clarke Turner shows Wyoming Senator John Barrasso a map of NPR-3 facilities.

Wyoming Senator John Barrasso set aside a few hours to take a tour of RMOTC and the facilities at NPR-3 in January. Barrasso, who replaced Senator Craig Thomas following his death last year, visited with staff in RMOTC's Casper office before being whisked off to the field for a tour of the facilities and a briefing on several past and present RMOTC projects.

The Wyoming delegation in Washington, D.C., has been very supportive of RMOTC since its inception in 1994. Representative Barbara Cubin, Senator Mike Enzi, and former Senator Craig Thomas have been cheerleaders for the program and its value to the oil and gas industry as well as the country. **Calling RMOTC "successful and innovative," Barrasso has also pledged his support to the program.**

SCIENCE BOWL

RMOTC HOLDS 10TH ANNUAL DOE-SPONSORED EVENT FOR WYOMING

The Wyoming Regional Science Bowl came right down to the last question in the championship round held in February in Casper. In the end, Star Valley High School's Team 1 (of Afton) edged out Kelly Walsh High School Team 2 (of Casper) by a score of 40-32. The Star Valley team and coach traveled to Washington, D.C., to represent Wyoming at the Department of Energy's National Science Bowl May 1-6.

The Wyoming Regional Science Bowl is one of 64 regional events held nationwide. The competition is sponsored by the U.S. Department of Energy (DOE) and hosted locally by RMOTC.

This year marked the 10th annual Wyoming Regional Science Bowl. RMOTC hosted 15 teams from seven communities around the state.

Science Bowl provides Wyoming high school teams (four students plus one alternate per team) the opportunity to show off their knowledge of all things science. The quiz format includes questions in Biology, Chemistry, Math, Physics, Earth Science, General Science and Astronomy.

A team from Star Valley High School in Afton, Wyoming, won the regional Science Bowl competition and represented Wyoming in the National Science Bowl.

RMOTC

Rocky

Mountain

Oilfield

Testing

Center

907 North Poplar

Suite 150

Casper, WY 82601

888.599.2200

www.rmotc.doe.gov

PRESORTED
STANDARD
U.S. POSTAGE
PAID
CASPER, WY
PERMIT NO. 165

RMOTC BRIEFS

New Customer Operations Center nears completion

RMOTC will unveil partner workspace in the newly renovated Customer Operations Center this summer. The space is centrally located in the field for easy access to partners' projects and features three individual offices with phones, a fax machine, and internet connections for easier access to the home office. Along with a kitchen, restrooms, and a shower, there is also a large, heated bay for working on equipment during testing.

Teapot Dome history on display

Over two years ago, the Fort Caspar Museum broke ground on an expansion of its existing facility. To be included in the expansion was a new exhibit on the history of the oil and gas industry in Natrona County. Museum staff approached RMOTC for help in creating a display on the historical development of Teapot Dome, including the scandal that surrounded it in the 1920s. The display is now open to the public during regular museum hours.

Catch up with RMOTC in Denver

After a busy spring tradeshow season, things have slowed down for the summer. But you can still catch RMOTC this summer at the Energy Epicenter conference in Denver. The Rocky Mountain Section of the American Association of Petroleum Geologists (AAPG) and the Colorado Oil and Gas Association (COGA) are jointly hosting the convention July 9-11, 2008. For more opportunities to visit with RMOTC staff, go to www.rmotc.doe.gov.