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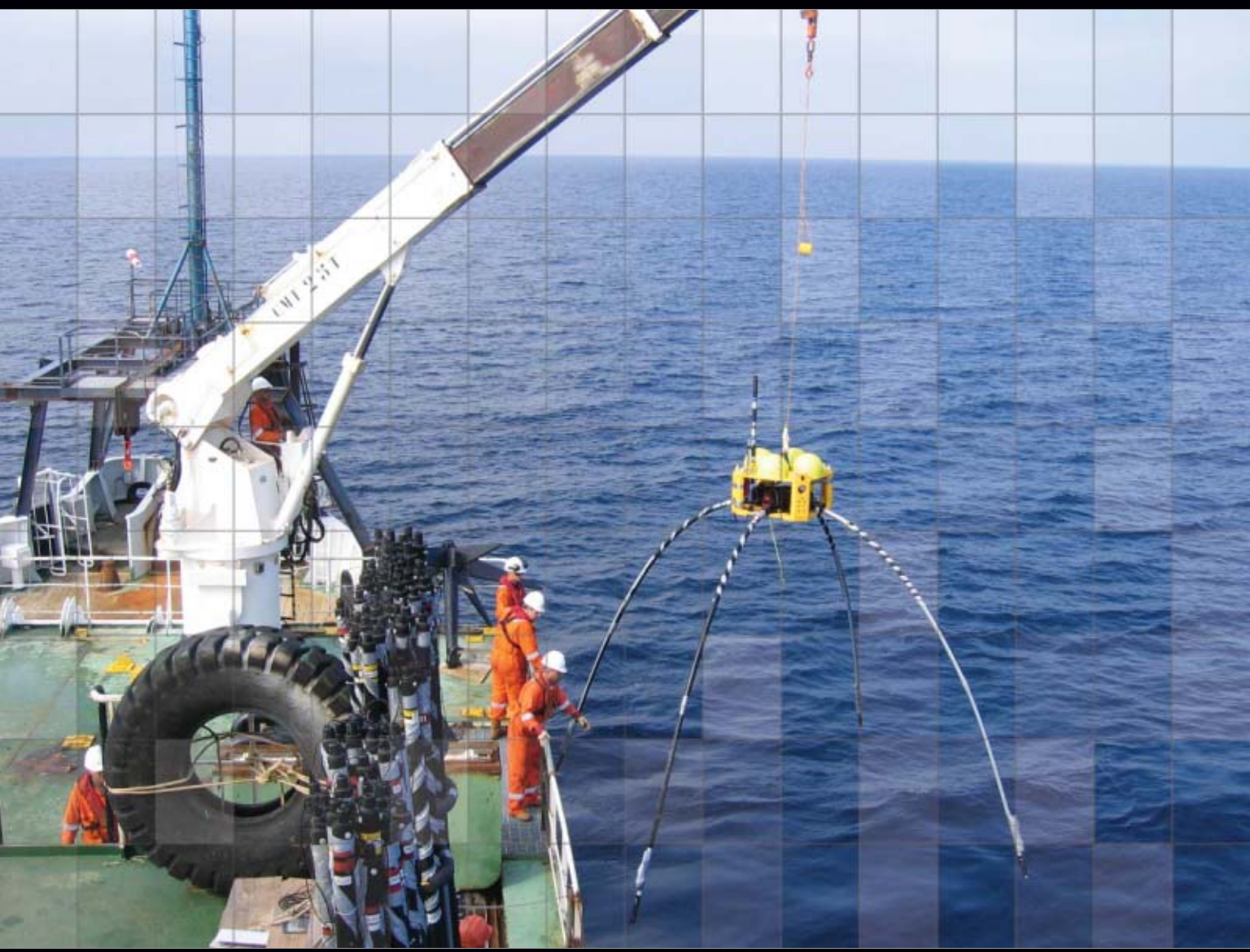


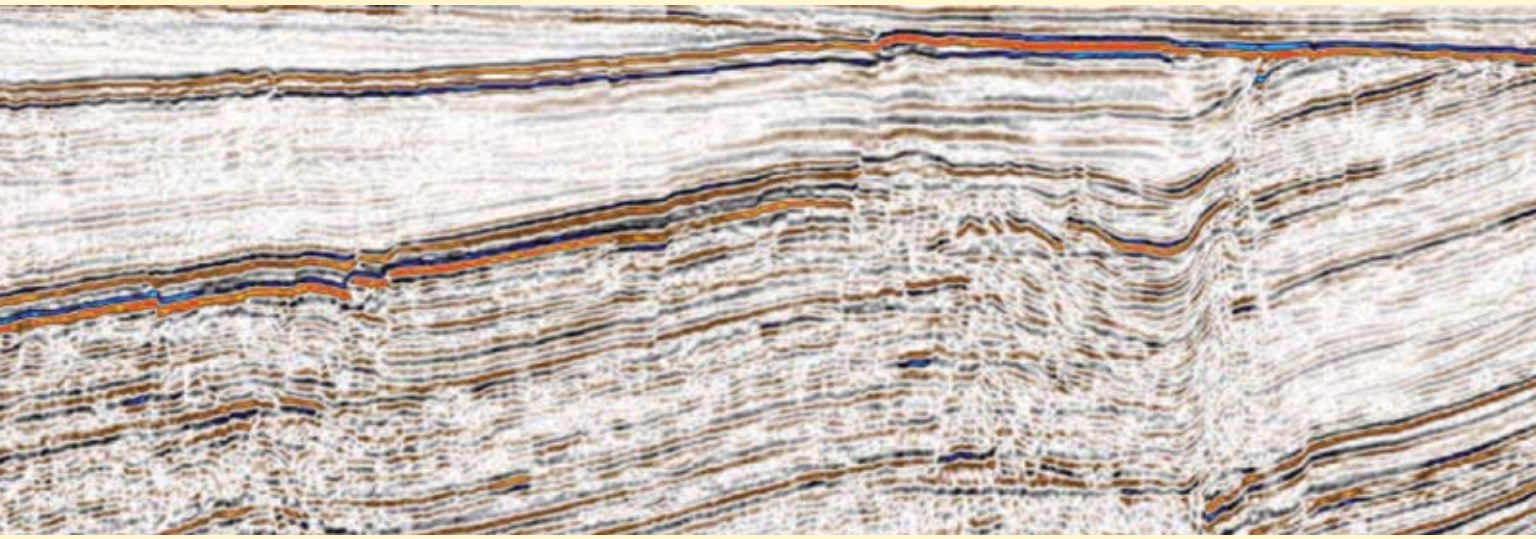
Applied Geophysics

Extended reach drilling targets 40,000 ft and beyond
New method improves back-allocation at processing plants
Software hones system-wide pipeline corrosion assessment

OIL&GAS JOURNAL®

Oct. 2, 2006
Volume 104.37

APPLIED GEOPHYSICS



REGULAR FEATURES

COVER

Workers on a geophysical vessel lower a receiver that will accept signals generated in a controlled source electromagnetic imaging survey. OGJ's Applied Geophysics special report starts on p. 18 with an interview with the new president of the Society of Exploration Geophysicists and has an article about the CSEM technique on p. 33. Photo from Offshore Hydrocarbon Mapping PLC.

General Interest

Exploration & Development

Drilling & Production

Processing

Transportation

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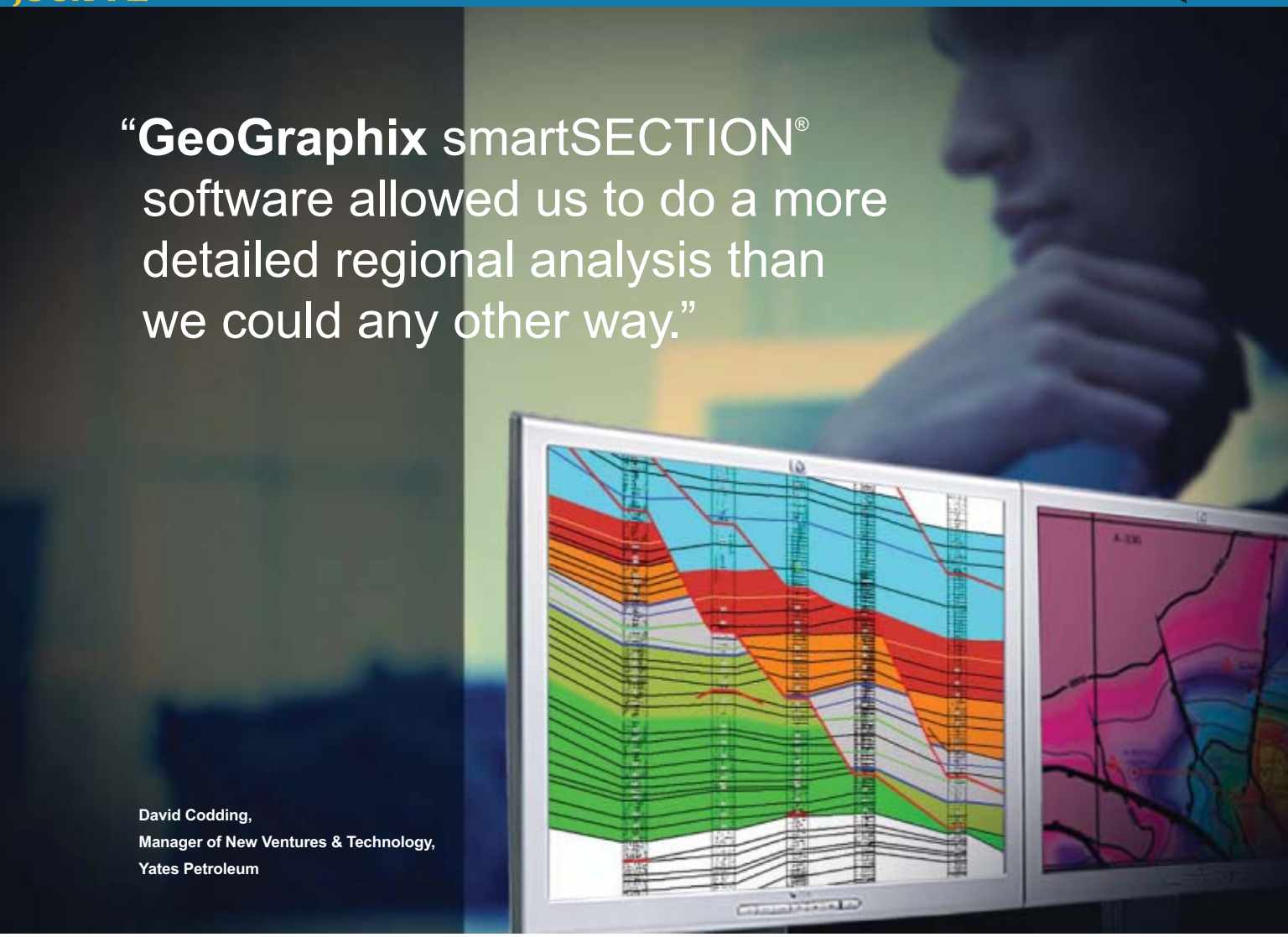

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OGJ Newsletter

Oct. 2, 2006

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General Interest — Quick Takes

EU energy production drop forces higher imports

While the total amount of energy required to meet the demand of the 25 European Union countries in 2005 remained the same as in 2004 at 1,637 million tonnes of oil equivalent (toe), a 4.5% fall in EU energy production from all sources pushed up its dependence on imports to 56% from 54%, according to Eurostat, the EU's statistical office, in its first 2005 estimates.

Crude oil production decreased by 9%, gas production by 5.8%, coal by 5.7%, and nuclear energy by 1.3%. The UK accounted for 70% of the oil produced, followed by Denmark 15%, with production falling in both countries by 11.4% and 3.8%, respectively.

The UK also was the EU's largest natural gas producer, with 44% of total production, followed by the Netherlands at 32%. In both countries production fell by 7.7% and 5.9%, respectively.

Oil accounted for about 60% of the EU's net energy imports, and gas for 25%. Net crude imports and products rose by 2.9%, while net gas imports rose by 9.2%.

Eurostat has determined that energy consumption per capita in the 25 EU member states was equivalent to 3.6 toe in 2005, compared with 7.8 toe/capita in the US and 4.1 toe/capita in Japan. But consumption varies greatly from one member state to another, reflecting economic development, the degree of industrialization, and climates.

SEC, former Willbros exec settle bribery charges

The US Securities and Exchange Commission said it reached an agreement on Sept. 14 with Jim Bob Brown, who formerly worked for a Willbros Group Inc. subsidiary, to settle charges that he violated antibribery provisions of the Foreign Corrupt Practices Act.

In a civil action filed in Houston federal court, SEC also alleged that Brown circumvented internal controls and falsified records while he was a supervisor in Willbros's Nigerian operations.

It said that Brown participated in three separate schemes to bribe foreign officials in Nigeria and Ecuador.

The complaint alleged that in February and March of 2005, Brown procured $1 million on behalf of a Willbros affiliate, which he delivered as partial payment to Nigerian government officials and to employees of a joint venture majority-owned by a Nigerian government division. It said he also assisted in paying another $550,000 to satisfy earlier commitments.

Second, in return for Willbros receiving a $3 million contract, Brown allegedly assisted in a scheme to pay $300,000 to officials of an oil and gas company owned by the Ecuadorian government, according to the complaint.

Finally, it said, Brown knowingly assisted a long-running scheme in which employees of Willbros affiliates fabricated invoices to procure cash from the company's Houston headquarters for bribing Nigerian tax and court officials and for other purposes.

Brown neither confirmed nor denied the allegations in the settlement. Pursuant to the judgment, the court will determine, at a later date in response to an SEC motion, whether Brown will have to pay a civil penalty, the federal agency said.

DOE to support CO_2 EOR at Citronelle, Ala.

A project to inject carbon dioxide into Alabama's largest oil field to improve recovery and later store the greenhouse gas will have its costs shared by the US Department of Energy.

DOE plans to provide nearly $3 million of the $6 million cost of the enhanced oil recovery project in Citronelle field operated by Plano, Tex.-based Denbury Resources Inc. in Mobile County 25 miles northwest of Mobile. The project could recover 64 million bbl of oil, DOE said.

The University of Alabama-Birmingham proposed the project to DOE. After economic oil production ceases, it calls for storage in the reservoir and adjacent formations of CO_2 produced from the combustion of fossil fuels in power plants and other processes.

Southern Co., Atlanta, one of the country's largest electricity generators, is evaluating the capacity of such reservoirs as possible locations for permanent sequestration of CO_2 separated from coal and natural gas combustion products in its power plants, DOE said. Project goals are to provide oil field operators and CO_2 producers with improved estimates of the oil yields from EOR and the capacity of depleted reservoirs to sequester CO_2. Another objective is to improve reliability of computer simulations of the oil yield and sequestration capacity of a given geologic formation and the rate at which CO_2 can be injected.

Other project participants are the University of Alabama-Tuscaloosa, Alabama A&M University, Huntsville; Geological Survey of Alabama; and the University of North Carolina, Charlotte.

Denbury also plans CO_2 EOR injection projects in Tinsley and Eucutta fields in Mississippi. The natural CO_2 to be injected will originate in that state (OGJ Online, Nov. 28, 2005). ✦

Exploration & Development — Quick Takes

Shell, Maersk to drill new block off Brazil

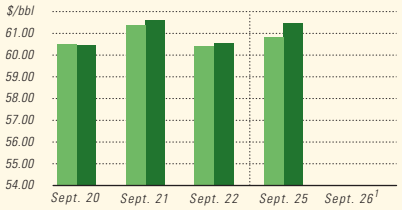
Royal Dutch Shell PLC and Maersk Oil & Gas AS plan next year to drill the first exploration well on the BMS-31 Block in the Santos basin off Sao Paulo, Brazil.

Shell, the block's operator and majority stake holder, is conducting seismic studies on this and on its other Brazilian blocks.

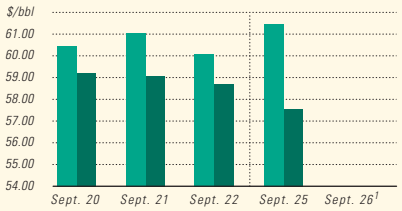
John Haney, Shell's vice-president of Brazilian E&P, said the company also plans in October to drill an appraisal well on the

Industry Scoreboard

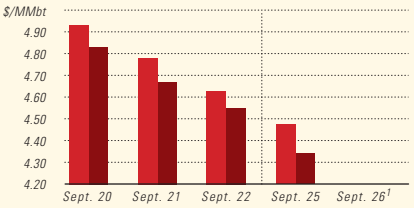
IPE BRENT / NYMEX LIGHT SWEET CRUDE



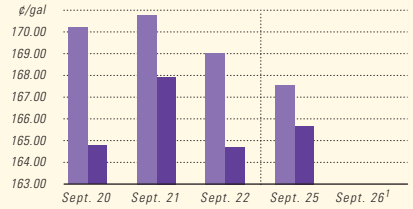
WTI CUSHING / BRENT SPOT



NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



IPE GAS OIL / NYMEX HEATING OIL



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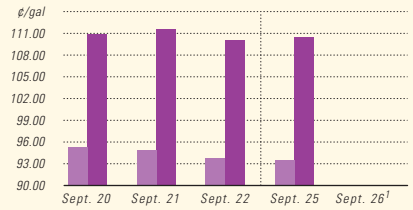
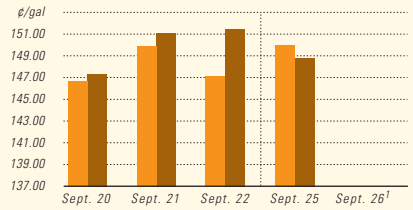


NYMEX GASOLINE / NY SPOT GASOLINE[2]



[1] Not available at press time.
[2] Nonoxygenated regular unleaded.

SCOREBOARD

Due to the holiday in the US, data for this week's industry Scoreboard are not available.

BS-4 Block in the same basin. The company has until yearend to declare this block commercial or return it to Brazil's National Petroleum Agency.

The block has reserves of 300 million bbl of very heavy crude. Shell holds a 40% operating stake.

In the Campos basin at Shell's 50%-held BC-10 Block, production of 17-24° gravity oil reportedly could start in late 2007 or early 2008. BC-10 was declared commercial in December 2005 and has a potential to produce about 100,000 b/d of oil from oil reserves of 400 million bbl (OGJ Online, Jan. 23, 2006).

Seismic indicates giant gas at Sampaguita

The 1976 Sampaguita gas-condensate discovery in the South China Sea northwest of Palawan Island could be an accumulation of as much as 20 tcf of gas, said Forum Energy PLC, London.

Interpretation by consulting engineers of 3D seismic data acquired over the structure confirmed a minimum of 3.4 tcf of proven gas in place in the three wells. It also confirmed the structure's extension to a possible closure of 290 sq km, which would yield an estimated 10 tcf in these sands alone. Untested sands known to contain gas could double the higher figure.

Previous estimates of Sampaguita's resource were 1 to 17 tcf with a likely 5 tcf (OGJ, Nov. 19, 2001, p. 49).

Forum, which holds 100% of the equity in Reed Bank GSEC 101, is converting the license to a service contract and plans to drill an appraisal well as soon as possible. The license is 250 km west of Malampaya gas and oil field.

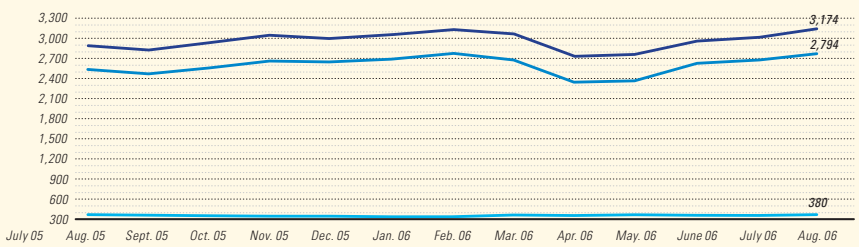
NW Alberta gas resource play adds momentum

EnCana Corp. is building gas production at a resource play in the deep basin of west-central Alberta to which it attributes 2 tcf of unbooked resource potential.

The company drilled 20 wells in the play in 2004, 51 in 2005, and 38 in the first half of 2006. Gas production averaged 95 MMcfd in the second quarter of 2006 compared with 55 MMcfd in 2005 and 42 MMcfd in 2004.

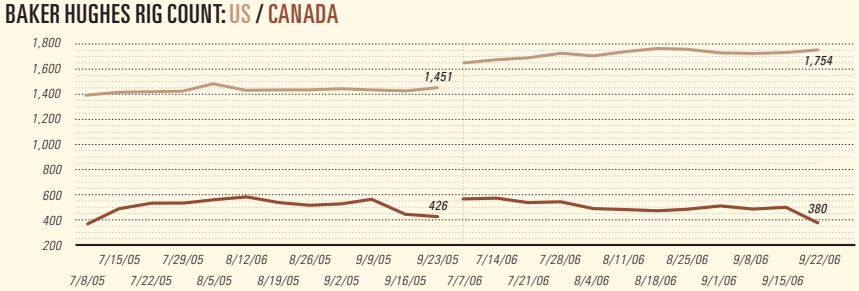
The company holds 448,000 net acres and is running eight rigs in the play, which produces from a deep basin Cretaceous reservoir. EnCana estimates original gas in

BAKER HUGHES INTERNATIONAL RIG COUNT: TOTAL WORLD / TOTAL ONSHORE / TOTAL OFFSHORE



Note: Monthly average count

BAKER HUGHES RIG COUNT: US / CANADA



Note: End of week average count

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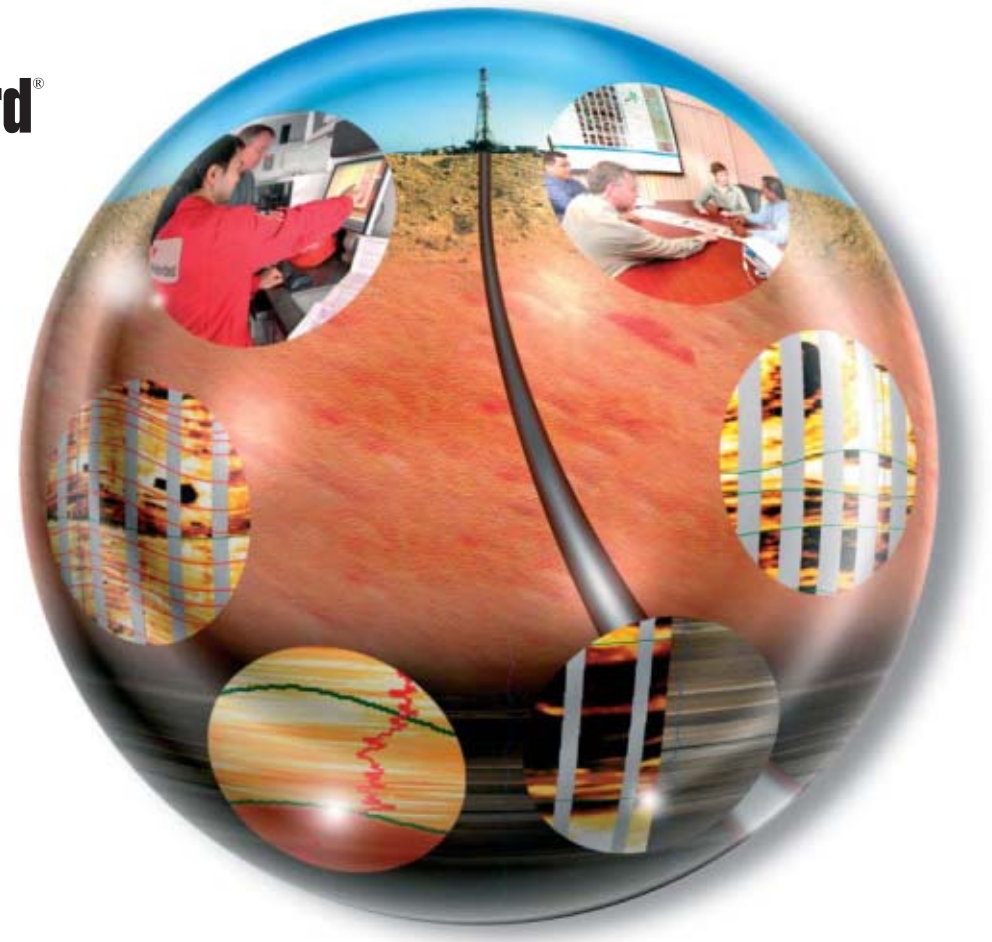

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place at 20 to 40 bcf/sq mile. It expects to drill two to four wells per square mile with the average well initially producing at the rate of 2 to 5 MMcfd and ultimately recovering 2 to 5 bcf of gas.

Bighorn is one of nine gas resource plays in the company's portfolio.

Western Oil Sands exploring Kurdistan tract

A unit of Western Oil Sands, Calgary, has begun exploring a 914,000-acre block in Kurdistan southeast of Kirkuk under an exploration and production-sharing agreement with the Kurdistan Regional Government Sulaymaniyah Administration.

WesternZagros Ltd., seeking conventional oil and gas in the Zagros fold belt, has identified three large structures from satellite imagery and noted that the block has active oil seeps and oil shows in water wells. The subsidiary ran a preliminary 2D seismic survey in late 2005. The block lies 60 km southeast of and on trend with the southeastern edge of supergiant Kirkuk oil and gas field. The identified structures, Bawanoor, Kalar, and Shakal, are each more than 25 km in length.

The agreement, to become law after passage by the unified government, requires a $45 million work commitment that includes geological and geophysical programs and exploratory drilling. Drilling could begin as soon as late 2007.

Western Oil Sands has assigned the block 1.7 billion bbl of risk-adjusted potential. The company has a 20% interest in the Athabasca Oil Sands Project in Alberta, with Shell Canada Ltd. holding 60% and Chevron Canada Ltd. 20%.

Dana Petroleum logs gas pay with Babbage well

Dana Petroleum PLC, Aberdeen, has reported the successful drilling and flow testing of Babbage gas field in the UK Southern Gas basin.

The Babbage appraisal well, on North Sea Block 48/2a, targeted a crestal area of the field with a view to proving gas reserves and productivity in order to proceed with development.

The well, drilled vertically to more than 11,000 ft TD, was spudded July 16 and found gas throughout a substantial Leman sandstone section. The well flow-tested at 10.7 MMcfd of gas without stimulation. The well will be suspended at the seabed and kept for use as a future gas producer.

Babbage, with as much as 390 bcf in place in Permian Rotliegend, could be tied back to Johnston 10 km north or Ravenspurn North 12 km northwest (OGJ Online, Sept. 28, 2005).

Dana holds a 40% interest in Block 48/2a. Partners are operator E.ON Ruhrgas UK North Sea 47% and Centrica Resources Ltd. 13%. Dana called the well's results "highly encouraging" and the partnership has already secured a rig for further drilling. Dana said Babbage field is now thought to be one of the largest undeveloped gas fields in the UK North Sea.

NWT field's bounty put at 20-30 million bbl

Cameron Hills field in the Northwest Territories could be an accumulation of 20-30 million bbl, operator Paramount Resources Ltd., Calgary, told financial analysts in mid-September.

Paramount, which has booked only 1-2 million bbl of reserves in the field, is producing 1,500 b/d of light, sweet crude and 7-8 MMcfd of gas.

Each of the 17-18 wells drilled has produced or tested oil or gas, but only two oil wells have been on sustained production because of the capacity of the 4-in. oil pipeline to Alberta.

The regulatory process has slowed the rate at which new wells can be drilled, Paramount said, and the field is the company's second lowest site for 2006 capital spending.

The company started producing gas in March 2002 and oil in April 2003 and has seen practically no decline in the oil rate. It placed a third well, J-74, on production last winter at 500 b/d.

Oil and gas are found in structural and stratigraphic traps in the Middle Devonian age Slave Point, Sulphur Point, and Keg River formations (OGJ Online, June 18, 2004). The field lies just northeast of the northwest corner of Alberta. ✦

Drilling & Production — *Quick Takes*

BP gets DOT nod to restart Prudhoe Bay field

BP Exploration (Alaska) Inc. said Sept. 22 it will restart a portion of the Eastern Operating Area (EOA) of Prudhoe Bay field in order to run cleaning pigs and conduct an in-line, smart pig inspection of the oil transit line.

DOT's approval will allow BP to run the smart pig through a 5-mile, 34-in. segment that carries oil from processing facilities on the field's eastern half.

The EOA was shut down Aug. 10 following the discovery of a spill caused by isolated pitting corrosion on Aug. 6 (OGJ Online, Aug. 10, 2006).

The company has determined that the line can be returned to service. Three of the four flow stations currently on warm stand-by will be returned to full production, the company said.

"This is an important milestone in returning all of Prudhoe Bay to production many months in advance of our complete replacement of 16 miles of oil transit lines," said David Peattie, BP Group vice-president for existing profit centers.

Results of the smart pig inspection will aid BP and the US Department of Transportation to determine whether to continue operations through the transit oil line or to shift production through a system of bypass lines currently under construction.

BP has performed tests on thousands of feet of the EOA pipeline using ultrasonic and other imaging equipment. As added precaution, BP's start-up plans include an enhanced spill-response contingency plan, in which crews and material will be positioned to respond if any leak occurs, the company said.

BP said safely restarting the field will take about a week. Resuming full operation of eastern Prudhoe should add about 200,000 b/d of oil production from the Alaskan North Slope. Current production from the rest of Greater Prudhoe Bay is about 250,000 b/d.

Chevron contract includes new drillship

Chevron Corp. awarded Transocean Inc., Houston, a deepwater drilling contract requiring construction of an enhanced version of

Transocean's Enterprise-class drillship, dedicated to Chevron's use for as long as 5 years.

Daewoo Shipbuilding & Marine Engineering Co. Ltd. will build the $670 million dynamically positioned, double-hull drillship in Okpo, South Korea. The rig will have a variable deckload of more than 20,000 tons. It will allow for parallel drilling operations and will have a larger, stronger, more efficient top drive than conventional rigs, enabling wells to be drilled to 40,000 ft TD in 12,000 ft of water, Transocean said.

Chevron has the right to convert the 5-year contract to 3 years if declared by September 2007. Revenues generated during a 5-year contract period are estimated at $862 million, or $609 million for 3 years.

The contract commencement date is scheduled for early 2010, and Chevron will take delivery in the Gulf of Mexico. This is the second drillship construction contract has Chevron awarded Transocean this year (OGJ, Mar. 6, 2006, Newsletter).

ReedHycalog: worldwide rig fleets see growth

Due to improved market conditions influenced by high oil and gas prices, the numbers of available rigs in the US, Canada, global offshore mobile, and international land all rose this year, according to Grant Prideco's 53rd annual ReedHycalog Rig Census.

Also, "Not only has the market upswing encouraged contractors to reactivate or refurbish their inventory of older units, but rig building programs have also been established and are now coming to fruition," said ReedHycalog Pres. John Deane.

The total number of US rig owners increased by 31 to 257 this year, as more companies found it economically viable to enter the market.

The US rig fleet realized a net gain of 13.5% over 2005 figures, bringing the fleet size to 2,298. This increase includes 391 additions, of which 238 were newbuilds, and 119 deletions.

US fleet utilization levels maintained a record high of 96%, a 1% gain over last year.

The Canadian rig fleet reached a new record high of 799 units, up from 741 in 2005. The increase included an addition of 63 newly manufactured rigs. The rig utilization for Canada, during the spring census period, had climbed 10 percentage points to 84%.

For the global offshore mobile rig fleet, 29 additions were realized this year. The fleet rose by a net 13 units to 654. This total took into account 20 reactivations and 9 new units, as well as losses due to hurricane damage and retired units. Currently, more than 90 units are on order or under construction, estimates ODS-Petrodata.

The international rig market saw a sharp increase in its overall utilization rate, which climbed to 95% for land rigs from 83% in 2005. China, Russia, and the former Soviet Union, which were excluded last year, have reentered the census with 100% utilization. This greatly increased Europe's and Asia's overall percentages. Russia and the FSU added nearly 500 rigs and China added over 1,100 units.

Petro-Canada signs rigs for exploration projects

Petro-Canada has signed several drilling rig contracts over the next 18 months for work associated with its international exploration program.

The company expects to begin a multiwell exploration and field development program in the UK North Sea near yearend and plans to begin drilling in Trinidad and Tobago in 2007, said Nick Maden, vice-president of exploration.

Maden added, "Work in the Zotti Block in Algeria will start in the fourth quarter of this year, and we now expect drilling on Block II in Syria to commence early in the first quarter of 2007."

Petro-Canada has secured the GlobalSantaFe Glomar Arctic III semisubmersible to be used in its UK work program, which includes development of Saxon oil field, in-fill drilling in Guillemot oil field, and three exploration wells, two of which recently were awarded in the 23rd licensing round. This contract is for 1 year.

Another contract is for Diamond Offshore Drilling Inc.'s Ocean Worker semisubmersible, which will start a 6-month, multiwell program on Block 22 in Trinidad and Tobago in the second half of 2007. Also at that time, the Rowan Gorilla III jack up will arrive on the Caribbean island for a 6-month, four-well program on Blocks 1a and 1b. This contract has an extension option to include an additional two wells.

Eurasia Drilling lets $65 million rig contract

Abbot Group PLC's land rig design engineering and fabrication subsidiary Bentec has been awarded a $65 million contract by Eurasia Drilling, formerly the drilling subsidiary of OAO Lukoil, for four 250-tonne, fast-moving hybrid rigs, derived from Bentec's original HR5000 design.

Work is to start immediately, with the first rig slated for delivery in 12 months. The other three rigs are planned for delivery by yearend 2007.

This latest contract brings to $200 million Bentec's order intake so far this year and to ten its number of rigs under construction (OGJ, Aug. 14, 2006, p. 39). ✦

Processing — *Quick Takes*

Petrotrin to use UOP technology for upgrades

Petrotrin has launched a 3-year gasoline optimization program at its 175,000 b/cd Pointe-a-Pierre refinery in South Trinidad.

The program involves constructing or revamping eight major plants, along with associated utilities and supporting units.

Four of the eight plants will use the proprietary technology of UOP LLC, Des Plaines, Ill.

UOP will provide technology for a CCR Platforming unit with a Chlorsorb system for reforming naphtha to produce high-octane fuel, a Penex unit for producing clean-burning gasoline, and a Merox unit for cleaning LPG.

It will also revamp a fluid catalytic cracker and upgrade the unit with a third-stage separator.

Russo-Indonesia JV to build Situbondo refinery

East Java Gov. Imam Utomo said a consortium of Russian inves-

tors and state-owned PT Petrogas Jatim Utama will build a $3 billion refinery in his province.

Utomo expects a contract to be signed in November for the facility, which will be built in Situbondo. Its initial capacity will be for 150,000 b/d, eventually rising to 300,000 b/d. The refinery will produce diesel, lubrication oil, and gasoline.

BP lets contract for coker at Spanish refinery

BP Oil Refineria de Castellon SA awarded a detailed engineering, procurement, and construction supervision contract to Foster Wheeler Iberia SA for a delayed coker at BP's 104,500 b/cd Castellon, Spain, refinery.

Terms of the contract were not disclosed. The planned 20,000 b/sd coker will use Foster Wheeler's proprietary delayed coking technology. Foster Wheeler is based in Clinton, NJ.

The new coker, scheduled for completion during 2008, is part of BP's planned reconfiguration of the Castellon refinery to reduce residual fuel oil production.

Details of the reconfiguration were not immediately available for the refinery in Castellon de la Plana, Spain (OGJ Online, July 15, 2002).

Shell lets turbine contract for GTL project in Qatar

A unit of Royal Dutch Shell PLC has let a contract to GE Oil & Gas for six 42-Mw gas turbines, equipped with dual fuel integrated gasification combined-cycle (IGCC) combustion systems, for the Pearl gas-to-liquids (GTL) project in Ras Laffan Industrial City, Qatar (OGJ, Aug. 7, 2006, Newsletter).

The contract scope includes IGCC combustion engineering, combustion system lab testing, spare parts, and training.

The gas turbines are capable of burning a range of low-btu fuel gasses, including a process off-gas derived from the core GTL reactors.

The turbines will be installed in the 140,000 b/d Pearl GTL plant in a cogeneration configuration that will produce 180 Mw of electric power for use in the facility.

Natural gas is the backup fuel, and will be used for plant startup. Steam injection will be used to reduce nitrogen oxide emissions.

The first gas turbine unit will be required to meet power requirements during the commissioning of the GTL facility, scheduled to begin commercial operation by 2009-10. The six units are scheduled for shipment in late 2007 or early 2008. ✦

Transportation — *Quick Takes*

Terminal problems delay Sakhalin-1 oil exports

The head of Russia's Federal Service for Ecological, Technological, and Nuclear Monitoring announced that Exxon Neftegas Ltd., operator of the Sakhalin-1 project, will not be able to start shipping Sakhalin oil for export until it has satisfied objections regarding construction of the oil terminal in the port of Dekastri.

"In violation of the law, the Dekastri oil terminal was being built in accordance with adjustments and additions made in the feasibility study before they were confirmed by experts in industrial safety," said Konstantin Pulikovskiy. "There are problems. One could open the terminal, but the problems must be resolved."

Pulikovskiy said he hoped the consortium developing the Sakhalin-1 project would correct the violations made during the construction of the Dekastri oil terminal in Khabarovsk Territory before the start of oil exports, scheduled for early October.

"We'll work to keep up with the schedule. The project is in place and must be implemented," Pulikovsky said when asked whether the problems could be resolved before the start of first exports. Two 100,000-tonne tanks in Dekastri are reported to have been filled with crude oil ready for export.

China proposes LNG terminal in Rizhao

China and EurOrient Financial Group have signed an agreement for construction of an LNG receiving terminal and related facilities in Rizhao City in Shandong province.

The proposed terminal is one of only 10 LNG projects to be commissioned in China along the coastal cities for the next 10 years by the state council.

The Rizhao terminal will have an initial capacity of 1.5 million tonnes/year of LNG. It will include a transshipment terminal and one or two storage tanks, pipelines, and gas distribution facilities. It will supply gas to Rizhao City and the greater Qingdao territory.

With estimated cost of more than $965 million, the project will be financed and developed in phases. The first phase will handle as much as 500,000 tonnes of LNG. EurOrient is considering various countries as suppliers, including Australia, Indonesia, Malaysia, Qatar, Oman, and Russia.

Pending receipt of a construction permit by December 2007, construction of the terminal is expected to start during first quarter 2008.

EurOrient said it is considering the Rizhao Lanshan Port as a possible location for the terminal.

Second Iran-Armenia gas pipeline on the horizon

In a visit to the Armenian capital of Yerevan, Iran's parliamentary speaker Gholam-Ali Hadad-Adel said his country wants to build a second natural gas pipeline to Armenia, according to the news service AFP.com.

This would augment a $220 million pipeline now in the last stages of completion and due to start up in January to deliver about 36 billion cu m over a 20-year contract.

Earlier in 2006, Armenia maintained that the 140-km pipeline was being built with an OD of 48 in., despite Russian pressure to reduce its OD to 28 in. The pipeline covers 100 km in Iran, with the balance traversing Armenia.

Until now Armenia has depended solely on Russian gas rather than importing hydrocarbons from closer Azerbaijan. That trade is prevented, said the news service, by the long-standing dispute between Armenia and Azerbaijan over the Armenian Nagorno-Karabakh enclave in Azerbaijan.

The report said Armenia will compensate Iran in part for the costs of the first pipeline with deliveries of electricity from a Soviet-era nuclear power plant. ✦

Calendar

✦ Denotes new listing or a change in previously published information.

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OCTOBER

SEG International Exposition & Annual Meeting, New Orleans, (918) 497-5500, (918) 497-5557 (fax), e-mail: meetings@seg.org, website: www.seg.org. 1-6.

IADC Drilling HSE Europe Conference & Exhibition, Amsterdam, (713) 292-1945, (713) 292-1946 (fax); e-mail: info@iadc.org, website: www.iadc.org. 3-4.

Canadian Offshore Resources Exhibition & Conference, Halifax, NS, (902) 496-3183, e-mail: amanda@otans.com, website: www.coreconference.com. 3-6.

Kazakhstan International Oil & Gas Conference & Exhibition, Almaty, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 3-6.

NPRA Q&A Conference, Phoenix, (202) 457-0480, (202) 457-0486 (fax), e-mail: info@npra.org, website: www.npra.org. 8-11.

Europe Multiphase Pump User Roundtable, Amsterdam, (979) 458-2054, (979) 458-1844 (fax), e-mail: becky@pe.tamu.edu, website: http://mpur.org/europe. 9.

ERTC Petrochemical Conference, Dusseldorf, +44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 9-11.

API Fall Petroleum Measurement Standards Meeting, Denver, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org/events. 9-12.

GPA Annual Meeting, Houston, (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gasprocessors.com, website: www.gasprocessors.com. 10.

International Bottom of the Barrel Technology Conference & Exhibition, Athens, +44 (0) 20 7357 8394, +44 (0) 20 7357 8395 (fax), e-mail: conferences@europetro.com, website: www.EuroPetro.com. 11-12.

Pipeline Simulation Interest Group Annual Meeting, Williamsburg, Va., (713) 420-5938, (713) 420-5957 (fax), e-mail: info@psig.org, website: www.psig.org. 11-13.

PIRA Annual Seminar, New York, (212) 686-6808, (212) 686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 12-13.

IOGCC Annual Meeting, Austin, (405) 525-3556, (405) 525-3592 (fax), e-mail: iogcc@iogcc.state.ok.us, website: www.iogcc.state.ok.us. 15-17.

EAGE/EAGO/SEG International Conference & Exhibition, Saint Petersburg, Russia, +31 30 6354066, +31 30 6343534 (fax), e-mail: stpetersburg2006@eage.org, website: www.eage.org. 15-18.

SPE/IADC India Conference, Mumbai, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 16-18.

Oil Shale Symposium, Golden, Colo., (303) 384-2235, e-mail: jboak@mines.edu, website: www.mines.edu/outreach/cont_ed/oilshale. 16-20

Annual European Autumn Gas Conference, Cannes, +44 1737 855 108, +44 1737 855 482 (fax), website: www.theeagc.com. 17-18.

Saskatchewan and Northern Plains Oil & Gas Symposium, Regina, (306) 787-2573, (306) 787-4608 (fax), e-mail: cgilboy@ir.gov.sk.ca, website: www.sgshome.ca. 17-18.

✦Energy Summit in Africa, Cape Town, 33 1 55 07 26 09, 33 1 55 07 26 55 (fax), e-mail: josee.foucault@enspmfi.com. 17-19.

ISA Expo, Houston, (919) 549-8411, (919) 549-8288 (fax), e-mail: info@isa.org, website: www.isa.org. 17-19.

Permian Basin International Oil Show, Odessa, Tex., (432) 367-1112, (432) 367-1113 (fax), e-mail: pbioilshow@pbioilshow.org, website: www.pbioilshow.org. 17-19.

Annual International Petroleum Environmental Conference, San Antonio, (918) 631-3088, e-mail: cese@utulsa.edu, website: www.cese.utulsa.edu. 17-20.

World LP Gas Forum & Global Technology Conference, Chicago, (202) 452-8975, (202) 452-9054 (fax), e-mail: willis@propanecouncil.org, website: www.wlpgasforum2006.com. 17-20.

Annual Border Energy Forum, Tampico, Tamaulipas, (512) 463-5039, e-mail: Soll.Sussman@GLO.STATE.TX.US, website: www.glo.state.tx.us/energy.border. 19-20.

GTI's Natural Gas Technologies Conference, Orlando, (847) 768-0940, (847) 768-0858 (fax), e-mail: NGT2006@gastechnology.org, website: www.gastechnology.org. 22-25.

IPAA Annual Meeting, Grapevine, Tex., (202) 857-4722, (202) 857-4799 (fax), website: www.ipaa.org/meetings. 23-25.

Power-Gen India & Central Asia Conference, New Delhi, (918) 831-9160, (918) 831 9161 (fax), e-mail: registration@pennwell.com, website: www.pgen.events.pennnet.com. 24-26.

DryTree & Riser Forum, College Station, Tex., (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.drytreeforum.com. 24-26.

West China International Oil & Gas Conference & Exhibition, Xinjiang, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 24-27.

✦Annual Condensate & Naphtha Forum, Phuket, +65 6222 0230, +65 6222 0121, e-mail: condensate@cconnection.org, website: www.cconnection.org. 30-31.

Chad International Oil & Gas Conference, N'Djamena, +44 207 596 5148, +44 207 596 5071 (fax), e-mail: colins.tchanga@ite-exhibitions.com, website: www.african-events.com. 30-31.

API Fall Refining and Equipment Standards Meeting, San Francisco, (202) 682-8000, (202) 682-8222 (fax), e-mail: petroteam@api.org, website: www.api.org. Oct. 30-Nov. 1.

✦Carbon Capture and Storage in the UK Conference, London, +44 (0) 20 7467 7100, +44 (0) 20 7255 1472, e-mail: info@energyinst.org.uk, website: www.energyinst.org.uk. 31.

NOVEMBER

AAPG International Conference and Exhibition, San Juan, (918) 584-2555, (918) 560-2694 (fax), e-mail: postmaster@aapg.org, website: www.aapg.org. 4-7.

AAPG International Conference & Exhibition, Perth, (918) 584-2555, (918) 560-2694 (fax), e-mail: postmaster@aapg.org, website: www.aapg.org. 5-8

Utah's 30-year prospect

Alan Petzet
Chief Editor-Exploration

After Covenant field in Sevier County, Utah, which opened oil production on the Central Utah thrust belt, where will explorers discover the next potentially giant oil or gas field in the US Lower 48?

Perhaps it will be up the road in Summit County, Utah.

A group led by Double Eagle Petroleum Co., Casper, Wyo., spudded a wildcat at Christmas Meadows, Utah, in late September.

The well is expected to cost $10 million and take 100 days to drill to TD 15,730 ft. Double Eagle cemented 34-in. conductor pipe at 235 ft and 20-in. conductor at almost 1,000 ft before Unit Drilling Co. moved in Rig No. 233 to drill the vertical Table Top Unit No. 1. The drillsite's surface elevation is 9,573 ft.

Outlays prior to spud totaled $2.5 million for environmental permitting and building the road and location.

The large subsurface feature, a structural dome, appears on numerous 2D seismic lines, but no 3D data have gone into the drilling of this prospect. Overlying the dome, in the southwest corner of the Green River basin, is the Rocky Mountain Overthrust Belt.

Various operators have been attempting to drill this well since the 1970s.

Progressive suitors

The former Gulf Oil Corp. noted the Christmas Meadows prospect on a regional seismic grid in the 1970s.

Later 2D seismic surveys by Gulf, American Quasar Petroleum Co., Amoco Production Co., Chevron Corp., Sohio Petroleum Co., and others supported the dome's existence.

Amoco staked a location in 1982 to drill a wildcat to 19,000 ft on the structure but had still not been issued a permit in 1986, when it dropped its plans.

Double Eagle first acquired leases on the prospect in 1984. Then Chevron formed a federal unit in 1989 and staked a well but withdrew in 1994, having been unable to get a drilling permit or buy offset acreage offered for sale.

Chevron turned the project over to Amerac Energy Corp., which designated Double Eagle as its agent. Double Eagle acquired the last acreage critical to the prospect at a US Bureau of Land Management auction in November 2003.

Double Eagle holds interests in 42,095 gross acres, of which 22,875 gross acres are included in the Table Top Federal Exploratory Unit.

Seismic search

Double Eagle and partners have acquired licenses to six 2D seismic lines that span 60 miles.

The various exploration organizations reprocessed five lines covering 53 miles with the state-of-the-art prestack depth migration (PSDM) technique.

Imaging and understanding of the structure improved as a result, although the structure map appears similar on all four of the PSDM maps generated, said Stephen H. Hollis, Double Eagle president and chief executive officer.

Hollis said, "It's a tough seismic area with lots of velocity problems to deal with. The geophysicists would prefer to have 3D seismic, but shooting 3D in a national forest in rough terrain was just prohibitive."

Not until it reaches 11,000 ft is the well expected to drill out of the last thrust sheet and into the underlying Green River basin, Hollis said.

The Christmas Meadows structure's position underneath the thrust is similar to that of Utah's Bridger Lake oil and gas field, which doesn't produce from beneath the thrust, and the size of the seismic feature is similar to Wyoming's Anschutz Ranch East gas-condensate field, he noted.

The prospect

The Christmas Meadows structure appears to have prospective formations that range in depth from 4,000 ft to 23,000 ft and in age from Mississippian to Cretaceous.

Obviously a 15,730-ft well will not see the three deepest formations: Jurassic Nugget estimated to be at 17,100 ft, Pennsylvanian Weber at 20,930 ft, and Mississippian Madison at 22,500 ft.

This makes the present wellbore mainly a test of the Cretaceous Dakota and Frontier, Double Eagle said.

The well has about a dozen working interest owners. Double Eagle and one other entity hold 25% each, Unit Corp. has 5%, and Basic Earth Science Systems Inc., Denver, has 2%. ✦

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Editorial

Energy and tax reform

The US oil and gas industry can improve both its standing with a hostile public and energy policy by seeking reform in an area not directly related to energy: tax policy.

The connection with energy is indirect but strong. Congress implements energy policy largely through the Tax Code. The Energy Policy Act of 2005, for example, created tax credits for purchases of hybrid vehicles, home energy-efficiency improvements, small producers of biodiesel and ethanol, and the manufacture of energy-efficient appliances and hybrid and alternative-fuel vehicles. It offered a deduction for fuel cells installed in buildings. It created tax incentives for the production of various kinds of energy. It offered so many tax incentives for so many kinds of energy and behavior that it's impossible to tell what it actually did for energy, other than please people able to profit from the gimmicks.

Tax complexity

Compounding the confusion is an altogether incomprehensible and always-changing set of tax statutes. In fact, complexity partly explains why simplification efforts never progress very far. Because most US taxpayers understand little about how the government affixes its claims to their wealth, they naturally fear that change might deepen the bite. Meanwhile, special interests never rest, so tax law becomes ever more complex and opaque.

Energy policy implemented through tax incentives can only founder in tax law this messy. The oil and gas industry has a chance to make things better because the mess soon will worsen.

Since 1969, the US has operated a parallel income tax system to ensure that clever rich people don't escape the financial obligations of citizenship. Now enshrined in the alternative minimum tax (AMT), the system is approaching an expansion likely to jolt many Americans out of their ambivalence toward tax law.

The AMT applies taxation rates lower than those of the normal income tax but allows fewer deductions and exemptions. Taxpayers who might be subject to AMT must calculate liabilities under both systems and pay whichever is greater.

When enacted in 1978, the AMT was supposed to apply to a relatively small number of very wealthy people. But that's changing rapidly, reports Alan D. Viard, Federal Reserve Bank of Dallas senior economist and research officer. From Urban-Brookings Tax Policy Center data, Viard predicts in the bank's August Economic Letter that the number of Americans subject to AMT under current law will jump to 4 million this year from 200,000 in 1990. In 2007, it will leap to 22 million.

Taxpayers newly susceptible to AMT aren't millionaires. According to Viard, taxpayers with incomes of $200,000-500,000/year are most likely to pay AMT. In 2010 and 2015, the share of AMT taxpayers with incomes of $100,000-200,000 will become "quite high."

Reasons are complicated for this rapid encroachment of taxation aimed at the very wealthy into the upper middle class. Unlike those of the regular income tax, the AMT's brackets aren't indexed for inflation. And tax cuts of recent years have caused AMT liability to exceed normal liability for growing numbers of taxpayers. That trend will accelerate as AMT exclusions enacted with some forms of tax relief expire. And in 2007 the tax-free threshold on the AMT rate schedule will drop.

In recent years, Congress has delayed the problem with short-term adjustments, many of which are expiring. It can continue doing so, of course. It also can repeal the AMT. But both options lower government revenue. They both increase in fiscal difficulty as AMT liability spreads.

Increasing discontent

Yet the spread continues, and growing numbers of taxpayers are finding themselves subject to complexities and tax surprises designed for much wealthier people. Discontent with the Tax Code can only increase in the next couple of years, putting tax reform once again at the center of politics in a presidential election.

For the oil and gas industry, that's an opportunity. There's no need to advocate one form of tax reform over others. It would please a disaffected public for the industry just to show shared interest in the need for change. If the effort succeeded, it also would improve energy policy. ✦

POINT OF VIEW

New SEG chief helped bring vector seismics into practice

Bob Tippee
Editor

A set of techniques known as vector seismics has migrated from research to practice, changing how geophysicists study the subsurface and improving information about the physical characteristics of oil and gas reservoirs. Leon Thomsen, who becomes president of the Society of Exploration Geophysicists at the group's annual meeting this week, has helped this once-esoteric idea become a practical tool of geophysics.

Twenty years ago, Thomsen wrote an article in SEG's technical journal, Geophysics, that proved to be fundamental to vector seismics and that SEG identified last year as the most frequently cited work in the profession. Since then, the subject has developed to the point that Thomsen, principal geophysicist and senior advisor in the Exploration and Production Technology unit of BP America Inc., now predicts, "In the future, all geophysicists will be vector seismologists."

With experience in both research and application of vector seismics, Thomsen speaks with authority when he says, "To get new ideas into practice is maybe the hardest part of exploration geophysics." Yet he holds a view of the role of research in oil and gas companies that's not wholly in line with pessimism often expressed on the subject.

An appreciation for Thomsen's perspective requires an understanding of how vector seismics is influencing geophysical work and how the concepts have evolved.

Reshaping geophysics

Vector seismics advances a well-established trend in which seismic techniques provide information not only about locations of boundaries between subsurface rock layers but also about physical characteristics of the rocks themselves, such as lithology, fluids, fracture content, and pore pressure.

The general trend progresses as geophysicists learn to extract more and more information from seismic reflection data. Vector seismics treats a seismic wave as a propagating package of particle displacements, with both magnitude and direction, instead of as a simple pressure pulse.

Conventional seismic work focuses on the compressional mode of the seismic wavefield, or "P-waves," in which material vibrates in a direction parallel to the direction of propagation. Until recently, exploration geophysicists have paid much less attention to shear waves, in which material vibration is perpendicular to the direction of propagation, and to converted waves, which are shear waves generated upon reflection of a downward-moving P-wave.

Conventional P-wave analysis is scalar, depicting reflection time, location, and signal strength without indicating the vector direction of particle motion within the wave. Scalar P-wave analyses therefore omit important information about the wavefield—and thus about

subsurface features.

Thomsen's 1986 article laid the foundation for work in this area by clarifying the concept of anisotropy. The traditional assumption, he explains, had been that subsurface media are isotropic for sonic propagation, meaning that the velocity at which sound energy moves through them is the same regardless of the direction of travel. Yet velocity fundamentally is a vector (with both magnitude and direction) rather than a scalar, like pressure (with magnitude only).

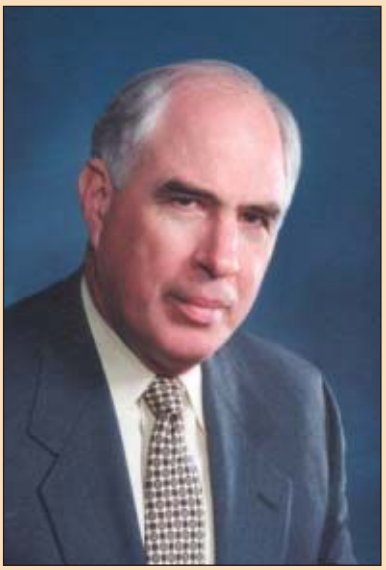
"Casual inspection of any sedimentary outcrop reveals a layered sequence, indicating that the velocity must be different in different directions: that is, that velocity is anisotropic," Thomsen says. On closer inspection, "one usually finds joints and cracks, further indicating that the velocity must vary in all directions."

The crucial point: "Seismic waves propagate as vectors. If we don't take full advantage of that in our acquisition practice and our theory and our processing and our interpretation, then we're just missing out on some of the information content that they're bringing back."

Vector concepts are both enriching the reservoir information available from interpretation of seismic data and improving established seismic tools. One such tool is amplitude variation with offset (AVO), in which interpreters infer rock type and other reservoir characteristics from observations of how reflection signal strength (amplitude) changes in relation to the distance between seismic energy sources and receivers (offset).

Until recently, most AVO has been based on isotropic assumptions. But the increasing use of wide-azimuth seismic surveys, in which source-receiver offsets cover a wide range of directions, has produced data that challenge the isotropic view.

"We normally find that there is an azimuthal variation with AVO, that the AVO response changes with a change in direction between sources and receivers," Thomsen says. "As soon as you start acquiring wide-azimuth datasets you see it all the time."



"In the future, all geophysicists will be vector seismologists."

—Leon Thomsen, principal geophysicist and senior advisor, BP America Inc.

How it evolved

Thomsen's work in subsurface anisotropy began 6 years before Geophysics published his article on the subject, shortly after Amoco Corp. hired him out of academia to work at its research center in his hometown, Tulsa. Thomsen's father Erik had been an interpretive geophyicist with Amoco forerunner Pan American Petroleum Co.

During a visit to Amoco's Denver office, Thomsen was presented with a question emerging in 2D paper sections from crossing seismic lines. Although reflections aligned as expected, their amplitudes differed. Why?

From previous work with crystals, Thomsen could see a possible answer. Crystals are all anisotropic. Maybe, he thought, anisotropy, contrary to normal assumptions, could be at work in subsurface media, too.

During the next couple of weeks, Thomsen worked out the concept eventually published in his famous 1986 article.

"What we were seeing in these 2D sections was an expression, in stacked 2D data, of what we now call AVO," he explains. Because the data were stacked, with reflection values from recordings at different offsets combined to improve signal-to-noise ratios, "We didn't see the angular variation with offset. But we saw how that summed up in the stack."

The researchers also saw that the effect was different with different offset directions.

"That's what we now call azimuthal variation of AVO—or AVOAz, a hot topic these days," Thomsen says. But that was the 2D era; practical use of the finding with P-wave data had to await wide-azimuth 3D data, which is only recently becoming available.

Shortly after this initial work on anisotropy, Thomsen's Amoco colleague Heloise Lynn provided him a shear-wave dataset in which velocities on crossing lines differed in value.

Thomsen says, "The interpretation was clear: cracks in the subsurface, fractures and joints and cracks of all scale with preferential alignment, which meant not only that P-waves were propagating in different directions but also that vertically propagating shear waves with different polarizations would propagate at different speeds."

The shear-wave analog to what the Amoco researchers had seen in the P-wave data is now called shear-wave splitting: the dependence of shear-wave velocities on polarization of the wave as well as on the direction of propagation. Because interpretation didn't depend, as it does with P-waves, on availability of wide-azimuth 3D data, early research in anisotropy focused on shear waves. But shear-waves attenuate more than P-waves do, so practical application of the

Career highlights

Leon Thomsen is principal geophysicist and senior advisor in the Exploration and Production Technology unit of BP America Inc.

Employment

Thomsen joined Amoco Corp., later merged into BP PLC, in 1980, after serving as a member of the faculty of the State University of New York at Binghamton. During his 8 years at the university, he spent a sabbatical at the Australian National University in Canberra and was a visitor at the Goddard Space Flight Center in New York. He earlier worked at the Centre Nationale de la Recherche Scientifique in Paris, at the California Institute of Technology in Pasadena, and at IBM Corp. in San Jose, Calif.

Education

Thomsen holds a BS in geophysics from Cal Tech and a PhD in geophysics from Columbia University.

Affiliations

He has been a member of SEG's Research Committee since 1987 and was committee chairman in 1998-2000. A 1994 recipient of SEG's Reginald Fessenden Award, he served as editor of the group's Geophysical Developments Series of 1994-98. He now serves as a trustee associate of the SEG Foundation and chairs the foundation's Project Review Committee.

Thomsen served as an SEG distinguished lecturer in 1997 and as an SEG/European Association of Geophysicists and Engineers (EAGE) distinguished instructor in 2002.

He's an honorary member of the Geophysical Society of Houston and of EAGE. He was appointed a foreign member of the Russian Academy of Natural Sciences and received the group's Kapista Medal in 2004.

shear-wave findings had to wait.

"It took maybe 20 years for the science and practice to mature to where we can do it with P-waves," Thomsen says. "But now we're there."

The payoff? From wide-azimuth data recorded with multicomponent instruments, which detect shear as well as compressional energy, interpreters are increasingly able to describe the intensity and direction of subsurface fractures and thus to assess such key reservoir characteristics as permeability.

In addition, Thomsen points out, what the Amoco researchers had learned about shear waves helped them use converted waves to image through shallow gas accumulations, which obscure deeper reservoirs in many parts of the world. Amoco, which merged with BP in 1999, applied the lesson at Valhall oil and gas field in the Norwegian North Sea.

Science vs. technology

Experience moving vector seismics from concept to application has sharpened Thomsen's views of putting ideas into practice.

"The hard part is not the science; the hard part is the technology," he says. The difference? "Science is hard to keep secret, and technology is hard to propagate, even to yourself. The hard part is to get your own colleagues to understand it and to use it every day."

Thomsen has come to believe strongly in the need for researchers to work in close physical proximity to people applying technology. The communication not only helps professionals in the field learn about new ideas but also boosts creativity of researchers, he says.

"Intelligently applying what you already know how to do is a big challenge," he adds. "Every company struggles with it."

But the reward can be great.

"A lot of research is useless. Maybe most of it is useless," Thomsen says. "However, I believe that the small fraction which turns out to be useful can pay for the whole program and a lot more. But it's a very inefficient process, whereas when you're taking up the challenge of applying what you already know, that's really an efficient process. You can't lose with that."

He acknowledges the lament of many observers that oil companies have reduced their commitment to research and concedes that most companies no longer have their own research laboratories. But he says companies to some degree have simply integrated research with operations.

Like many companies, for example, BP has set up disciplinary interest groups that foster learning and communication. And it has designated advisors, of which Thomsen is one, able to use some of their time to pursue research in areas of their choice. Inevitably, the research yields unpredictable benefits.

BP recently commissioned the design, construction (by Fairfield), and deployment of 900 autonomous, four-component recording nodes in the Gulf of Mexico to test the utility of wide-azimuth seismic recording in deep water. The nodes are designed to record continuously while on the seafloor for about a month. The first survey using the new equipment recorded densely spaced shots for subsalt imaging over Atlantis oil field. BP will report results at SEG's New Orleans meeting.

During the test, the largest earthquake in the gulf's recorded history occurred just 10 miles from the seabottom array of recording instruments, which proved to be sensitive to the low-frequency data used in earthquake seismology. By luck of timing, the active shooting didn't interfere with the earthquake.

"It's an extremely interesting dataset," Thomsen says, and will be discussed at an SEG workshop at the annual meeting. "The importance of it has yet to be demonstrated. Understanding it might be really important for the

safety of our operations in the Gulf of Mexico or maybe not. The experts haven't yet put their heads together."

Whatever the practical value of the earthquake data, Thomsen adds, "this dataset will be taught to university students for decades."

Oil and complexity

Thomsen cites the earthquake workshop as an example of SEG's role in advancing geophysical knowledge and technology. That know-how will be crucial to a "painful transition" to sustainable energy sources.

"It will be up to geophysicists," he says, "to help find the oil to buy the time to pave the way for the transition."

What can be said with confidence about that transition is that simple ideas of the past won't be enough.

"I think we've found all the oil that's going to be found with simple ideas," Thomsen says. "It takes more-complex ideas and more-complex practice to find the more difficult oil."

The challenge of the geophysical profession, then, is "to find the oil that wasn't findable by the technology of today." ✦

EPA's new air standards cut fine particulate limits

Nick Snow
Washington Correspondent

The US Environmental Protection Agency announced new air quality standards on Sept. 21 that would reduce daily allowable fine particulate matter levels by almost 50%.

Particulate matter is a complex mixture of extremely small airborne particles and liquid droplets, according to EPA. It said the new National Ambient Air Quality Standards (NAAQS) address both fine particles (as small as 2.5 μm) and inhalable coarse particles (2.5-10 μm).

The new standards will have a bigger impact on electric power generators than on oil and gas producers. But the American Petroleum Institute said in a statement it was troubled by EPA's action covering fine particles, which it found to be "overly conservative and based on incomplete science."

In a separate statement, National Petrochemical & Refiners Association Pres. Bob Slaughter said the new NAAQS for fine particulates "represents a significant and costly burden placed on all industrial and commercial operations, including refining and petrochemical facilities."

Joe Stanko, counsel for the Electric Reliability Coordinating Council, said the previous standard ultimately provided more protection than was anticipated in 1997 when it was adopted. The new one, meanwhile, will cost $20-60 billion/year, "making it the most expensive federal regulation since the [White House] Office of Management and Budget began keeping records of regulatory costs in 1981," he continued.

Other groups said the agency did not go far enough. "Overwhelming evidence shows that millions of people suffer unnecessarily—even face an earlier death—because they breathe this pollution. EPA could have—should have—done better," said John L. Kirkwood, president of the American Lung Association (ALA) in New York.

"Regardless of the rhetoric, facts are facts. Today, EPA is delivering the most effective national air standards in US history to all 300 million Americans," administrator Stephen L. Johnson said.

Specific impacts

The new standards reduce the allowable fine particulate limit to 35 μg/cu m of air from the previous 65 μg/cu m. EPA estimated that this would result in $9-75 billion/year of health benefits.

The agency also decided to retain the current annual standard of 15 μg/cu m for long-term exposure to fine particles. It said meeting this standard would produce $20-160 billion/year of health benefits, based on recently updated estimates.

EPA also retained the daily coarse particle limit of 150 μg/cu m. But it revoked the annual coarse particle exposure limit because available evidence does not suggest a relationship between adverse health effects and long-term exposure to coarse particles, it said.

API said the Clean Air Act requires EPA to review the latest scientific information and standards every 5 years. API said it participated in the latest review by the scientific community, industries, public interest groups, the general public, and EPA's Clean Air Scientific Advisory Committee.

EPA's choice of a 35 μg/cu m fine particle limit "will lead to emission controls that may limit the ability of our industry to secure and expand energy supplies," API said. It supports Johnson's decision to retain the current annual fine particle standard, it added.

NPRA's Slaughter also said the original standard for fine particulates was more protective than EPA assumed upon its adoption in 1997.

"We are concerned that the standard issued today burdens states by moving attainment targets before implementation of the 1997 NAAQS for particulate matter. The EPA should not change the existing standard now, before the states develop plans to meet the existing standard," he said.

Kirkwood said ALA recommended a daily 25 μg standard and an annual 12 μg standard for fine particles. "While almost any improvement in the weak 1997 standards is better than nothing, EPA's modest revisions cannot be justified," he said. ✦

Burton outlines possible past lease royalty terms

Nick Snow
Washington Correspondent

Holders of deepwater Gulf of Mexico leases issued in 1998 and 1999 probably would be required to pay royalties starting with the date they agreed to amended terms, US Minerals Management Service Director Johnnie Burton said.

"We're still talking, so I'm a little nervous getting too specific," she said during an event sponsored by Platts. But, she added, collecting royalties from a period before a producer agreed to accept previously absent price thresholds would be legally difficult.

Burton said she also has ordered MMS employees to fully document steps taken to reach decisions with e-mails and written correspondence. The lack of such documentation in the 1998-99 period has made it harder for both MMS and the Department of the Interior's inspector to conclusively determine why price thresholds were omitted from deepwater leases at that time.

"The central question is whether a decision was made to drop price thresholds or if it happened accidentally," Burton said. "What the inspector general has told me so far is he hasn't found any willful wrongdoing, no intentional effort to escape payments. There may have been faulty communications that resulted in a communications breakdown between two MMS divisions."

She said the administration of President George W. Bush considers the situation a matter of contract law. "It feels that when a contract has been signed by two parties in good faith, that contract needs to be respected. If one of the parties finds the terms aren't so good, they have to live with it," she said.

Burton also said if Congress passes a bill barring 1998-99 leaseholders who don't renegotiate terms from participating in future federal offshore leasing, "I think there would be a question of whether it constitutes a breach of contract and a company might decide to sue. That's a difficult issue. But if we tell them that they can't play in this park any more, where are they going to go? Probably to Africa or someplace else overseas, and I think the taxpayers would lose as a result."

Burton also said the administration is anxious to see an Outer Continental Shelf leasing bill and hopes that the Senate and House can reconcile differences between their two measures. She said the US Bureau of Land Management might modify its planned lease sale at the National Petroleum Reserve-Alaska to omit parcels covered by a recent federal court ruling. ✦

NPRA praises action for increased DHS authority

Nick Snow
Washington Correspondent

The National Petrochemical & Refiners Association praised US House and Senate conferees on Sept. 26 for giving the Department of Homeland Security authority to regulate certain high-risk chemical plants.

But NPRA tempered its commendation by expressing regret that the regulatory authority, which will be inserted in the federal agency's fiscal 2007 budget, is scheduled to expire after 3 years.

"The petrochemical and refining industries have made and will continue to make major, long-term investments in protecting facilities, employees, and the surrounding communities from potential threats. We should be able to do so with the knowledge and confidence that requirements will not change every few years," NPRA Pres. Bob Slaughter said.

Nevertheless, the association said the agreement reached by conferees the evening of Sept. 22 was a favorable response to DHS's request for authority to establish high-risk security standards for comparably high-risk facilities.

The agreement also adds a requirement for chemical plants to assess their vulnerabilities and create and implement security plans based on those vulnerabilities, subject to approval by the DHS secretary.

DHS also would gain the authority to require compliance with its security requirements, including the right to audit and inspect facilities and to shut down plants that do not comply under the agreement, which will be submitted to the joint appropriations committee.

"NPRA agrees that the provision should not cover facilities already subject to the extensive security requirements of the Maritime Transportation Security Act (MTSA), and that the regulations should permit each covered facility to select appropriate measures to meet the standards set by DHS," Slaughter said.

He added that the trade association is pleased that the DHS legislation takes a stance similar to the MTSA in protecting vulnerability assessments and specific site security plans from unwarranted public disclosures.

The measure also provides for the appropriate sharing of information with state and local law enforcement officials, along with first responders whose duties may require in-depth knowledge of security-related information, according to Slaughter.

"The DHS and industry have created

WATCHING GOVERNMENT

Nick Snow, Washington Correspondent

If Democrats take control...

It's not a foregone conclusion. But it is possible that the Democrats will regain control of at least the US House of Representatives in November's election. The question then would be the extent to which the congressional energy agenda would change.

Unlike many other issues, energy can be bipartisan, particularly when it comes to oil and gas. The division more frequently is between producers and consumers than political parties. Republican Bobby Jindahl and Democrat Charlie Melancon agree that Louisiana should get a share of revenue from federal leases off their state.

Nevertheless, the emphasis would change in the House because Democrats would schedule hearings and move legislation if they became the majority party. A bill to authorize oil and gas leasing in the Arctic National Wildlife Refuge obviously would face more obstacles, for example.

But the House also might become less aggressive in its Outer Continental Shelf leasing reform proposals and accept the Senate's more focused bill. High storage levels may keep natural gas prices from climbing very far before the election, while gasoline prices have fallen so far since Labor Day that they no longer seem to be as big an issue.

Several proposals

Still, there are several proposals by Democrats which have not been fully considered in 2006 that could move ahead in 2007 if Republicans lose control of the House.

On July 25, leading House Democrats introduced what they called the "PROGRESS Act."

The bill would establish a national energy security commission, to develop national goals, a Manhattan Project-style center to create an advanced vehicle efficiency consortium, and a national biofuels infrastructure development program.

It also would try to improve biofuel transportation by stimulating domestic freight railway investments and require federal and state governments to use more biofuels, develop biofuel plants across the country, and speed development of standards to promote alternatives to oil.

Products reserve

House Democrats also responded to rapidly climbing gasoline prices late last spring with a promise to revive their proposal to create a strategic products reserve as an alternative to a Republican-backed bill to ease refinery permitting, which eventually passed the full House and awaits Senate action.

They also appear more likely to propose moving investigations and prosecutions of alleged oil product price-gouging from the states to the federal government. Bart Stupak (Mich.), ranking minority member of the Energy and Commerce Committee's Oversight and Investigations Subcommittee, introduced a bill in September to give the Federal Trade Commission that authority.

Such proposals suggest that Democrats would mandate energy goals instead of simply relying on market forces if they assume control of the House. ✦

an outstanding working relationship in the shared fight against terrorism. This working partnership has been very effective in enhancing industry's ability to focus on those security threats that exist today and the potential threats that we may face in the future," he said.

Slaughter said NPRA and its members look forward to continue working with DHS as the federal agency develops final regulations to replace the interim authority it will receive under the fiscal 2007 budget that emerged from the congressional conference. ✦

Venezuela, Iran sign series of energy accords

Peter Howard Wertheim
OGJ Correspondent

Venezuelan and Iranian officials on Sept. 17 signed a series of accords, including deals to develop oil fields, build factories, and set up a $2 billion investment fund to finance the projects.

The agreement is part of Venezuela's 24-year, heavy oil development plan during 2006-30 centered within the Orinoco Oil Belt, with an extension of some 210 sq miles. The Orinoco Belt is south of Guárico, Anzoátegui, and Monagas states.

Petroleo de Venezuela SA estimates that the 20,077 sq mile Orinoco Belt area contains 235 billion bbl of crude, which, added to the country's current 81 billion bbl in proved reserves, could elevate Venezuela's reserves to 316 billion bbl. Proved Orinoco reserves previously were estimated at only 36 billion bbl.

"We are in a program that should wrap up in November 2008," PDVSA Pres. Rafael Ramirez Ramirez said.

On Sept. 18, Iranian President Mahmud Ahmadineyad and Venezuela's President Hugo Chavez witnessed the initial drilling of a well in an Anzoategui State field to certify reserves. Iranian company Petropars Ltd. is participating as the major partner in that

field's development on Ayacucho Block 7, which extends for 500 sq km. Initial studies had indicated the existence of 31.2 million bbl of original oil in place, of which Petropars expects to recover at least 20%, or about 6 million bbl.

Petropars's well MFK-4E is about 125 km from San Tomé. PDVSA has invested $1 million in drilling well PDV No. 2, which will quantify reserves. With the drilling of these two first wells under the Orinoco Magna Reserve Project, Venezuela began the process of quantifying and certifying its Orinoco Belt oil reserves on Sept. 21.

PDVSA partners

The extensive Orinoco Oil Belt is divided into 27 blocks within four areas—Carobobo, Ayacucho, Junin, and Boyaca (see map, OGJ, Nov. 21, 2005, p. 54). PDVSA is certifying these blocks alone or in partnership with overseas companies.

In contrast to past policy, the country will exploit the Orinoco Belt oil in joint ventures with many international oil companies. Foreign oil companies currently working in the Orinoco Belt areas include ExxonMobil Corp., ConocoPhillips, BP PLC, Total SA, Statoil ASA, and Chevron Corp.

In participating in Venezuela's energy development, Petropars joins IOCs such as Uruguay's state oil firm Administration Nacional de Combustibles, Alcohol y Portland, Russia's OAO Gazprom, Repsol YPF SA of Spain, Brazil's state-owned Petroleo Brasileiro SA, Argentina's Energía Argentina SA, China's state-owned China National Petroleum Corp., India's Oil & Natural Gas Corp., and Belorusneft Production Association of Belarus.

Venezuela recently reassured foreign oil firms that they could keep majority stakes in projects refining heavy crude from the Orinoco Belt, but reiterated that the state would control upstream work with a stake of at least 51%. ✦

Russia moves to suspend Sakhalin-2 development project

Eric Watkins
Senior Correspondent

Russia's Ministry of Natural Resources (MNR), citing inadequate environmental safeguards, effectively decided Sept. 18 to suspend the Sakhalin-2 oil and gas development project.

The suspension affects Phase 2 of the project and appears to have been undertaken in a way to prevent any court action by the firms affected.

As a result of the move, construction work will be suspended until new environmental measures are drawn up, submitted to government authorities, and approved, said a ministry spokesman, who added that the suspension applies not only to pipelines but also production and shipment facilities.

Under Phase 2 of the project, operator Sakhalin Energy aimed to build two offshore platforms, a gas liquefying plant with throughput of 9.6 million tonnes/year, a gas condensate refinery, two lines of an 800 km pipeline, and an oil offloading terminal.

Sakhalin Energy denied the Russian government allegations about environmental problems on the development.

"Specific issues referred to by Rosprirodnadzor (the Russian environmental watchdog) and MNR are immaterial. All concerns are being addressed expeditiously in cooperation with the relevant authorities and do not constitute any legal grounds for annulment," it said.

"We are confident there are no valid grounds to revoke order 600, which approved the SEER's (state ecological expert review) conclusion for Sakhalin-2, Phase 2 in 2003, and thus, to invalidate the SEER's conclusion, which has been successfully defended in the Russian court as recently as Aug. 29, 2006," the statement said.

The move by the Russian government, however, appears to prevent any court action on the decision. MNR decided to rescind governmental approval for an environmental survey of the project, while the Russian Federal Service for the Supervision of Natural Resources also withdrew its lawsuit filed in Moscow calling for the Russian government to revoke its approval of the project.

As a result, a court will cancel a hearing on the case that was scheduled for Sept. 21, suggesting that Russian authorities have chosen to end the exploration project without resorting to court procedures.

Russian authorities are thought to be putting pressure on the Sakhalin consortium in order to improve the chances of a Russian firm joining the project.

Sakhalin-2 is the only major oil and gas project in the country in which a Russian company doesn't have a stake, although Royal Dutch Shell PLC is in talks with OAO Gazprom on trading up to 25% of Sakhalin Energy for a stake in another Russian gas field.

As part of Russian pressure, MNR Minister Yuri Trutnev said his country could lose billions in the Sakhalin-2 oil and gas project if operators continue to raise expenditures (OGJ Online, Sept. 14, 2006).

But the project operator denied that claim in a recent statement.

Petroleum Company of Trinidad & Tobago Limited
Exploration and Production Division
Land, North & East Coast Operations
Laboratory & Technical Support Services

ADVERTISEMENT

INVITATION TO PRE-QUALIFY FOR THE TREATMENT OF LNE'S PRODUCED WATER

Petroleum Company of Trinidad and Tobago Limited (Petrotrin) invites suitably qualified and experienced Contracting Firms with the requisite financial resources, work experience, manpower resources,equipment resources and client references to submit applications to pre-qualify for the treatment of produced water from its Land, North and East Coast (LNE's) operations.

DESCRIPTION OF SERVICES

The services to be provided are the ownership, design, fabrication, installation, operation, technical expertise and maintenance of a suitable technology and process/facility to be able to clean-up produced water generated at four separate locations namely: Galeota Tank Farm, Barrackpore Tank Farm, Guapo Tank Farm and Los Bajos Tank Farm. The treated water from these Tank Farms will have to meet or exceed the following specifications:

• CONTRACTOR ELIGIBILITY

Tank Farm	Approximate Discharge Volume (BWPD)	Specification for Treated Water
Barrackpore	3000	Inland discharge as per draft Trinidad and Tobago Water Pollution Rules, 2001
Galeota	3000	Near shore discharge as per draft Trinidad and Tobago Water Pollution Rules, 2001
Guapo	4000	Near shore discharge as per draft Trinidad and Tobago Water Pollution Rules, 2001
Los Bajos	20,000	Inland discharge as per draft Trinidad and Tobago Water Pollution Rules, 2001, OR Industrial Use, OR Potable Water

Contracting Firms (National and International) including those on Petrotrin's Contractors Register, are eligible to apply. Companies de-listed in Petrotrin are ineligible.

PRE-QUALIFICATION CRITERIA

Contracting Firms which satisfy eligibility requirements and wish to pre-qualify, will be evaluated on the following criteria:

i. Financial Capacity
ii. Technical Competence / Expertise in Performing Services of a Similar Nature,Value, Scope and Complexity
iii. Qualifications and Experience of Core Project Staff
iv. Adequacy and Availability of Resources

INVITATION DOCUMENTS

Contracting Firms wishing to obtain pre-qualification packages are required to pay a non-refundable fee of $TT 1,000.00 to the cashier, Administration, Building, Pointe-a-Pierre,during the period 2nd October 2006 to 20th October 2006 as follows:

DAYS	HOURS
Monday to Wednesday	7:30 a.m to 10:30 a.m. and 1:00 p.m. to 2:30 p.m.
Thursday	7:30 a.m to 9:30 a.m. and 1:00 p.m. to 2:30 p.m.
Friday	9:30 a.m to 10:30 a.m. and 1:00 p.m. to 2:30 p.m.

The pre-qualification package can be collected upon presentation of the receipt to the Contracts Specialist (Ag.) at any time during the period 2nd October to 20th October 2006 within the hours of 8.00 a.m. to 3.30p.m. :-

Mr. Brian Poliah
Room #37, Ground Floor
Administration Building
Pointe-a-Pierre
Republic of Trinidad and Tobago West Indies
Telephone: 1-868- 658-3297
Telefax: 1-868- 658-3262.

CLARIFICATION / QUERIES

All clarification / queries should be made no later than 3rd November 2006 and be directed to Mr. Brian Poliah - Contracts Specialist (Ag) at 868-658-4201 to 20, extension 2103.

CLOSING DATE FOR RECEIPT OF PRE-QUALIFICATION DOCUMENTS

Pre-qualification documents shall be written in ENGLISH and placed in a sealed envelope labeled and addressed:

INVITATION TO PRE-QUALIFY FOR TREATMENT OF LNE'S PRODUCED WATER

Sealed envelopes shall be delivered to the Contracts Specialist (Ag.) at the above stated address no later than 17th November 2006 at 2.00 p.m.

GENERAL

Petrotrin reserves the right to accept or reject any or all pre-qualification documents without defraying any costs incurred by the Firm submitting the pre-qualification documents, including but not limited to, the preparation and submission of such pre-qualification documents. Unsuitable applications will not be acknowledged.

WATCHING THE WORLD

Eric Watkins, Senior Correspondent

A softer tone on Sakhalin-2

No one would actually accuse Russia of backtracking, but last week its minister of natural resources said his country had no intention of removing an operating license from Royal Dutch Shell PLC for the Sakhalin-2 development project.

To be sure, Yuri Trutnev said his ministry would conduct a fresh investigation of Shell's compliance with environmental regulations. But he played down concerns that the undertaking would halt the project.

"There is no question of removing the license because of the result of the investigation," Trutnev said. "The inspection should only examine whether the operator is abiding by environmental protection legislation, not the other aspects of resource use in Sakhalin region or offshore."

Quick U-turn

That's a far cry from earlier statements from the ministry which—several weeks ago—had threatened to cancel the environmental license for the Shell-led project (see related story, p. 25). That would certainly have created delays if it did not disrupt the development altogether. The threat attracted a strong backlash from politicians around the world, and that backlash in turn doubtlessly contributed to Moscow's softened tone. Among the loudest voices of complaint were those of the normally quiescent Japanese. "Russia's recent move to revoke environmental approval for a mammoth international project to develop oil and natural gas deposits on Sakhalin Island has put the country's credibility as an energy supplier at risk," intoned an editorial in Japan's Nihon Keizai Shimbun. "Russia should realize that attempts to politically manipulate international energy projects could backfire by causing serious harm to the world's trust in the country as a reliable supplier of energy," the paper said.

Politicians object

Japanese politicians made themselves heard, too. Japanese Chief Cabinet Secretary Shinzo Abe even said that Russia's decision to revoke its approval of the development project might have an adverse effect on overall Japan-Russian relations.

Shell did not sit on its hands, either. A senior British Shell source last week acknowledged that his company had gone to the highest level in the British and Dutch governments to get support for its claims. And those efforts paid off. Russian President Vladimir Putin quickly assured Dutch Prime Minister Jan Peter Balkenende that "constructive negotiations" would be held with Shell. Balkenende phoned Putin, who told him: "The Russian authorities will continue to engage with the companies concerned in a constructive way."

Still, it seems to take a while for such messages to circulate. Hardly had the Shell flap begun to die down than the prosecutor general's office summoned Valery Pak, the boss of Rusia Petroleum, TNK-BP's 63%-owned operating company at the Kovytka gas field in Siberia.

It said: "Pak was warned that if the breaches of legislation are not remedied in a stated time, the prosecutor's office will apply to the federal subsoil-use agency for a cessation of Rusia Petroleum's right to exploit the Kovytka deposit." ✦

"Sakhalin-2 is the world's largest integrated oil and gas project, and with $20 billion of inward investment, it is the biggest direct foreign investment in Russia," the statement said.

"The economic benefits to the Russian Federation from these projects will total over $50 billion, assuming oil prices in the region of $34/bbl," it said.

It added that the decision could lead to delays in the project, which is scheduled to start shipping LNG to Japan as early as 2008. Investors in the project include Japanese firms Mitsui & Co. and Mitsubishi Corp.

Both firms declined comment but Japanese Chief Cabinet Secretary Shinzo Abe said the Russian decision could have an adverse effect on overall Japan-Russian relations, if the project faces what he called an "extended delay." He did not specify the length of time that might be.

Observers said the development could force the Japanese government to review its energy policy since Japan may no longer be able to rely on a project designed to diversify its sources of energy and reduce its dependence on supplies from the Middle East. ✦

Bolivia issues ultimatum to foreign oil companies

Peter Howard Wertheim
OGJ Correspondent

Bolivia Vice-President Alvaro Garcia Linera, acting as the nation's head while President Evo Morales is traveling abroad, told foreign oil companies operating in Bolivia that they have until Oct. 28 to agree to new contracts nationalizing the country's oil and gas industry.

Bolivia newspaper La Razon on Sept. 20 quoted Linera as saying, "If the oil companies do not sign the contracts, they will have to stop operations in the country."

Linera added that foreign oil companies have been slow in signing con-

tracts in hopes that the deadline will be extended.

Brazil's state-owned Petroleo Brasileiro SA (Petrobras) is not interested in leaving Bolivia, company officials said, but last May Petrobras announced it was suspending future investment after the neighboring country took state control of the gas industry and established that foreign oil companies had 180 days to sign the new contracts.

Petrobras, which has been in Bolivia since 1996, has invested $1.6 billion and is responsible for 20% of Bolivia's gross domestic product. The nationalization decrees force companies to cease autonomous oil and gas exploration and production and become service providers for Bolivia's state-owned Yacimientos Petroliferos Fiscales Bolivianos (YPFB).

On numerous occasions, Petrobras Pres. Jose Sergio Gabrielli emphatically declared that the Brazilian company would not accept being reduced "to the role of a service provider."

Soliz expropriated two refineries owned and operated by Petrobras and on Sept. 13 placed them under the control of YPFB (OGJ Online, Sept. 14, 2006). The two refineries' total output is 60,000 b/d.

New minister

Separately, politicians and private sector executives consider Bolivia's new hydrocarbons minister, Carlos Villegas, a moderate replacement for radical leftist Andrez Soliz, who recently resigned. They hope Villegas will smooth negotiations with Brazil and other foreign entities.

Yussef Akly, manager of coordination and strategy of the private sector organization Bolivia Hydrocarbons Chamber, told the Brazilian financial paper Valor, "We have to grant full support to the new hydrocarbons minister and a technical character to negotiations."

Brazil President Luiz Inácio Lula da Silva said, "It will be easier to negotiate with Villegas, a moderate, who will probably take a more technical approach."

On Sept. 18, Linera suspended a measure that would have exerted majority interest in the operations of Petrobras refineries in Bolivia.

On Sept. 19, Gabrielli said he hoped to restart negotiations with Bolivia concerning indemnification values for nationalized assets. Morales in May had said the companies would not be compensated for them (OGJ, May 22, 2006, Newsletter).

Villegas has already sought to lessen tensions by confirming that talks with 12 companies operating in Bolivia, including Repsol YPF SA, BG Group, and Total SA, will resume soon.

Before the nationalization of Bolivia's oil and gas, Brazil was requesting a review of the "bilateral gas import contracts" signed between Bolivia and Brazil. The 20-year gas supply agreement requires investments by Petrobras in Bolivia to increase oil and gas production and to maintain the volume of gas exports from Bolivia to Brazil.

Brazil currently imports 26 million cu m/day from Bolivia via the 3,150-km Bolivia-Brazil pipeline that started operating in July 1999, but now that conditions have changed and Bolivia wants to hike gas prices, that import contract may also require renegotiation. ✦

Brazil to invest heavily in gas production, LNG imports

Peter Howard Wertheim
OGJ Correspondent

Heavy investment in Brazil's natural gas industry by state-owned Petroleo Brasileiro SA (Petrobras) is resulting in a growing use of gas in the country's energy mix, particularly in gas-fired thermoelectric plants.

Gas use rose to 8.9% in 2004 from 7.7% in 2003 and underwent a further hike to 9.3% in 2005. Projections are that it will represent 11% in 2010 and 15% in 2015.

At the Rio Oil & Gas Expo in Rio de Janeiro, Petrobras's Gas and Energy Director Ildo Sauer affirmed that the company is the main investor in Brazil's gas industry and will continue to undertake increasing investments—alone or in partnership with private firms—to raise domestic production and imports of gas and to upgrade existing infrastructure.

According to Sauer, these investments and the importation of LNG will prevent a gas supply shortfall, particularly since Bolivia in May nationalized its gas sector, which exports 26-28 million cu m/day of gas to Brazil.

Supply, demand

Of the average 41.13 million cu m/day of gas consumed during January-July of this year, 2.6 million cu m/day was used for cogeneration, 24.1 million cu m/day was for the industrial sector, and 7 million cu m/day for electric power generation. Another 5.99 million cu m/day was consumed in the automotive sector, 625,000 cu m/day in the residential sector, 539,000 cu m/day in commercial establishments, and 185,000 cu m/day for CNG.

During 2006, Petrobras's average gas production has been 49 million cu m/day, of which 75% is associated gas. Sauer pointed out, however, that since 1995, the output of nonassociated gas has increased by 7.5%/year. For example, last year Petrobras produced 37.3 million cu m/day of associated gas and 10.7 million cu m/day of nonassociated gas, compared with 16.1 million cu m/day of associated gas and 6.1 million cu m/day of nonassociated gas in 1995.

Sauer estimates that by 2010, some 63.5% of gas produced will be nonassociated.

Petrobras and its partners will invest

as much as $22 billion in the gas chain in Brazil during 2007-11. Of this amount, about 14.9 billion will be spent on gas exploration and production. Petrobras will invest $11 billion and its partners, $3.9 billion.

Infrastructure

Petrobras also will invest $6.6 billion in gas and energy infrastructure. Private partners will add $500 million for a total of $7.1 billion. Petrobras is working to enable importation of LNG via floating storage and regasification units and shuttle vessels. The company is investing $40 million to build an LNG terminal at Pecém, in the northern state of Ceará, which will receive 6 million cu m/day of gas by February 2009, and another $140 million for a terminal at Guanabara Bay, in Rio de Janeiro state, that would receive 12-14 million cu m/day by the same date.

Sauer estimates the regasification price at 80¢/MMbtu.

In answer to an OGJ question about the status of the 10,000-km gas pipeline project to span South America from Venezuela to Argentina at an estimated cost of $15-20 billion, Sauer said, "Petrobras was providing input about the financial and technical viability of the project, especially because some two thirds of the pipeline would cross Brazilian territory."

The director said the political will to undertake the project exists as shown by the several accords signed between Presidents Hugo Chávez of Venezuela, Nestor Kirchner of Argentina, and Luiz Inácio Lula da Silva of Brazil.

Sauer concluded that the governments of Venezuela and Argentina are involved in feasibility studies but it was too soon to make any concrete and specific statements as to if and when the project would be implemented. ✦

Upstream costs keeping pace with oil prices, study says

Oil and gas companies' global upstream spending climbed to $277 billion in 2005, up 31% from 2004, said the latest annual review of upstream performance by John S. Herold Inc. and Harrison Lovegrove & Co. Ltd.

Investment levels set a record for the third consecutive year, yet capital investment still lagged cash flow for a fifth consecutive year.

Cash flow increased 32% to $322 billion. Worldwide revenues rose 37% to $699 billion from the previous year, according to statistics from more than 200 publicly listed companies. This implied an average realization of $37.10/boe during 2005, up 32% from 2004.

Net income jumped 44%, pushing the industry's bottom line to a total $202 billion. Profits from 2005 averaged $11.15/boe compared with a 3-year average of $8.54/boe.

Rising operating costs make it increasingly difficult for oil companies to boost oil reserves and production capacity, analysts said.

Lifting costs gained 35% last year to $201 billion, or an average of $10.69/boe. Finding and development costs increased 26% to $11.26/boe, while pure finding costs jumped 51% to $4.08/boe.

Reserves replacement costs surged 73% to $10.27/boe in 2005, while the reserves replacement rates continued to decline.

"The potential for stormy seas looms," said Herold Chairman and Chief Executive Officer Arthur L. Smith. Volumes of proved and proved developed petroleum liquids held steady for the second consecutive year.

Production, reserves

Oil production increased 1% worldwide in 2005, while gas production rose 2.2%. World oil and gas reserves increased 2%, on the strength of a 3.2% gain in gas reserves.

"The reserve picture is bleaker than the statistics imply," the study said. "For the third straight year, the industry failed to replace its oil reserves through the drill bit. Were it not for the recognition of substantial volumes at two Canadian oil sands projects, crude reserves would have been flat from 2004 to 2005.

"Developed oil reserve volumes dipped modestly—a serious impediment to short-term production growth—and were barely 2.4% greater than at the end of 2002," the study said.

Gas reserves increased by 3.2%, with the US and Asia-Pacific regions contributing more than half of the gain. Field extensions and discoveries exceeded gas production by a 14% margin, analysts said.

US oil and gas reserves grew after stagnating for several years, but production declined 6%. The US was the most profitable region for upstream producers, who reported average earnings of nearly $16/boe.

Canadian oil reserves jumped 30%, supported by growth in oil sands reserves bookings. Acquisition costs in Canada remained the highest in the world. European reserves and production continued to decline as escalating tax rates sapped reinvestment.

"World oil output will continue on its recent path of rather anemic growth, although short-lived production surges may occur as large-scale projects are commissioned," analysts said. "The tight supply-demand balance should provide a firm underpinning for crude oil prices."

New field exploration must receive an increasing share of the capital budget if the world's oil and gas industry is to sustain itself, the Herold study said, noting that many areas remain off limits to most companies.

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"While technological advances have kept the cost of finding oil reasonably in check, recent discoveries have been smaller than in prior years, or they have been in hostile environments, which has boosted development costs," analysts said, calling for expanded exploration efforts. ✦

COMPANY NEWS

CNR to buy Anadarko Canada in $4.24 billion deal

Canadian Natural Resources Ltd. (CNR) plans to buy Anadarko Canada Corp. (ACC) for $4.24 billion. Anadarko is keeping its interests in the Mackenzie Delta and other Canadian arctic frontier properties.

In other recent company news:

• Tullow Oil PLC, London, has agreed to acquire Hardman Resources Ltd., Perth, for about $1.47 billion (Aus.). The transaction, subject to 65 million new Tullow shares being issued and approval by Hardman shareholders, is expected to be completed by early January 2007.

• Statoil ASA plans to acquire interest in two Gulf of Mexico deepwater discoveries—Big Foot and Caesar—and one prospect from Plains Exploration & Production Co. for $700 million.

CNR-Anadarko Canada

ACC's land and production base are in Western Canada. Current production, before royalties, from the working interests being acquired by CNR, is 358 MMcfd of gas and 9,300 b/d crude oil and NGLs.

The assets include 1.5 million net undeveloped acres and key strategic facilities in the high-growth areas of northeastern British Columbia and northwestern Alberta. At yearend 2005, ACC reported proved reserves of 262 million boe, 75% of which was proved developed. The transaction, subject to normal closing conditions, is expected to close by Oct. 31.

Anadarko put its Canadian subsidiary up for sale to help raise $15 billion to reduce debt from its $21 billion purchases of Kerr-McGee Corp., Oklahoma City, and Western Gas Resources Inc., Denver (OGJ, July 10, 2006, p. 27).

CNR Pres. and Chief Operating Officer Steve Laut said the ACC acquisition strengthens the company's asset and production base in key operating areas, specifically gas production.

The ACC assets contain more than 1,500 identified drilling locations. Existing infrastructure will allow low-cost development of ACC lands and adjacent CNR property, Laut said.

Tullow-Hardman

The acquisition will double Tullow's prospective acreage and increase its production by 6,000 boe/d from a 19% interest from producing Chinguetti oil field off Mauritania. It also will increase Tullow's proved and probable reserves by 30%, adding an additional 105 million boe of 2P commercial and contingent reserves. In addition, Tullow will gain operational control and 100% interest in Block 2 in Uganda's Albertine basin, and will add 16 exploration wells to its 2006-07 exploration program.

Hardman Resources assets include exploration interests in Tanzania, Suriname, Guyane, and the Falkland Islands as well as Tiof and Tevet fields off Mauritania with future gas potential from eight contiguous blocks covering 58,500 sq km.

The enlarged group will hold more than 110 licenses in 21 countries, with Africa accounting for over 45% of the total.

For the 6 months ended June 30, Hardman Resources reported profits before tax of $31.1 million (Aus.) and net assets as at that date of $542 million (Aus.).

Statoil's GOM deal

Statoil's transaction is expected to close in early November. In addition, Plains E&P agreed to give Statoil a right of first negotiation for other deepwater gulf assets.

Statoil is acquiring a 17.5% interest in the Caesar discovery, operated by Shell Exploration & Production Co., and a 12.5% interest in the Big Foot discovery along with a 12.5% interest in Big Foot North prospect, both operated by Chevron Corp.

Caesar is 160 miles south of Houma, La., on Green Canyon Block 683 (OGJ, May 22, 2006, Newsletter). The Caesar well was drilled to 29,721 ft TD in 4,500 ft of water.

The Big Foot discovery, on Walker Ridge Block 29, lies in 5,000 ft of water about 225 miles south of New Orleans (OGJ, Aug. 7, 2006, Newsletter).

The new assets are in the Greater Tahiti area, where Statoil already was positioned.

The Caesar discovery is between the Chevron-operated Tahiti and Tonga discoveries, in both of which Statoil has a 25% interest. Tahiti is under development on Green Canyon Block 640 in 4,000 ft of water 190 miles southwest of New Orleans, and due to come on stream in 2008.

The Big Foot discovery is in the same geological trend as Tahiti and Caesar. Big Foot is in the Walker Ridge area, close to the Jack and St. Malo discoveries operated by Chevron. Statoil holds a 25% interest in Jack and 6.25% interest in St. Malo (OGJ, Sept. 11, 2006, Newsletter). ✦

Controlled source electromagnetic imaging offers synergies with seismic, well-log data

Dave Pratt
Offshore Hydrocarbon Mapping PLC
Aberdeen, Scotland

Within the context of record high exploration costs and the increasing difficulty in finding large hydrocarbon deposits, exploration companies face even more pressure to reduce risk to deliver results. The challenge faced by these companies means that geoscientists and commercial managers alike must understand and incorporate the latest technologies to reduce commercial risk.

Traditionally, companies have turned to seismic surveys to understand the properties of structures they are pursuing in the search for prospects to drill. However, even with the advent of 3D acquisition over 25 years ago, in most instances seismic has only been able to answer the question of whether or not a structural trap exists. Until recently the only way to find out whether hydrocarbons are present was to drill; dry holes are still commonplace, and reservoirs with little or no seismic expression are left untested.

Over the past few years, however, more companies have taken an interest in using a new remote sensing geophysical technique to reduce risk and make more accurate inferences about what lies below the surface. It is the one technique that is able to answer the question: "Does the subsea structure contain hydrocarbons?"

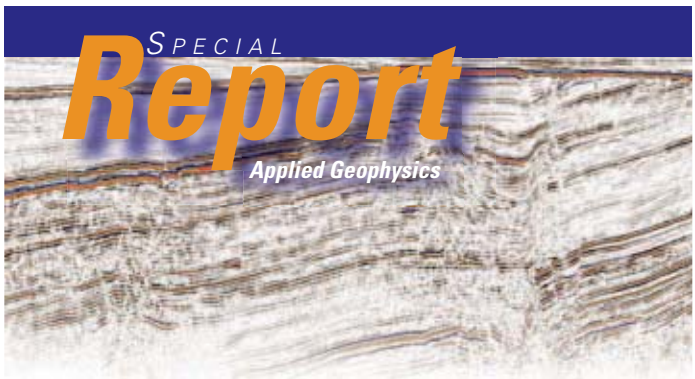
Controlled Source Electromagnetic (CSEM) imaging is gaining considerable recognition as a tool for offshore exploration to detect and delineate hydrocarbons—in particular to distinguish between hydrocarbon fluids and water; a distinction that seismic data alone cannot make. At its simplest, CSEM can provide an explorer with sufficient data from which a real decision can be made.

What is CSEM?

CSEM imaging has been used for over 20 years by researchers to examine the properties of fluids in the earth, initially over active hydrothermal and volcanic systems on midocean ridges.

The technology exploits the large variation in resistivity of a formation when conductive saline water is replaced by hydrocarbon. This variation can be mapped at a local or regional scale by studying its effect on an electromagnetic field transmitted through the sea floor, giving considerable insight into the subsurface geology.

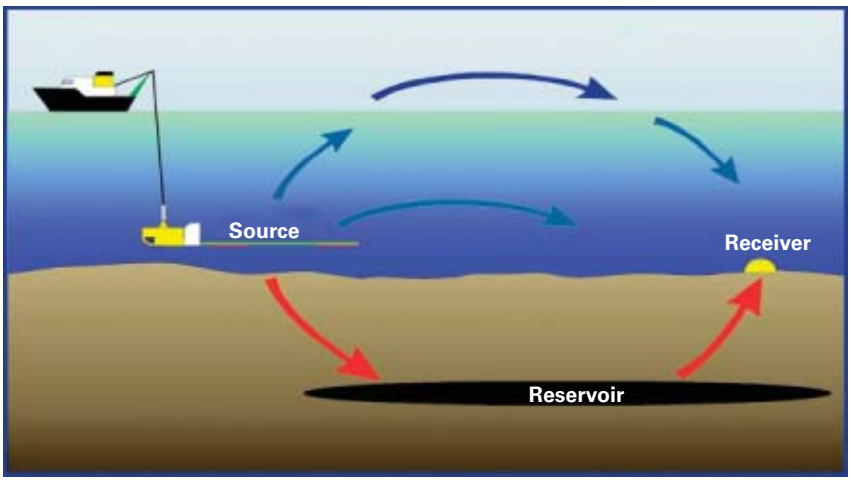
Seismic has a history of being instrumental in mapping subsurface structures and helping explorers to determine where reserves may lie, but it provides little information on the fluids within these structures. This is where OHM has seen CSEM make a large difference.

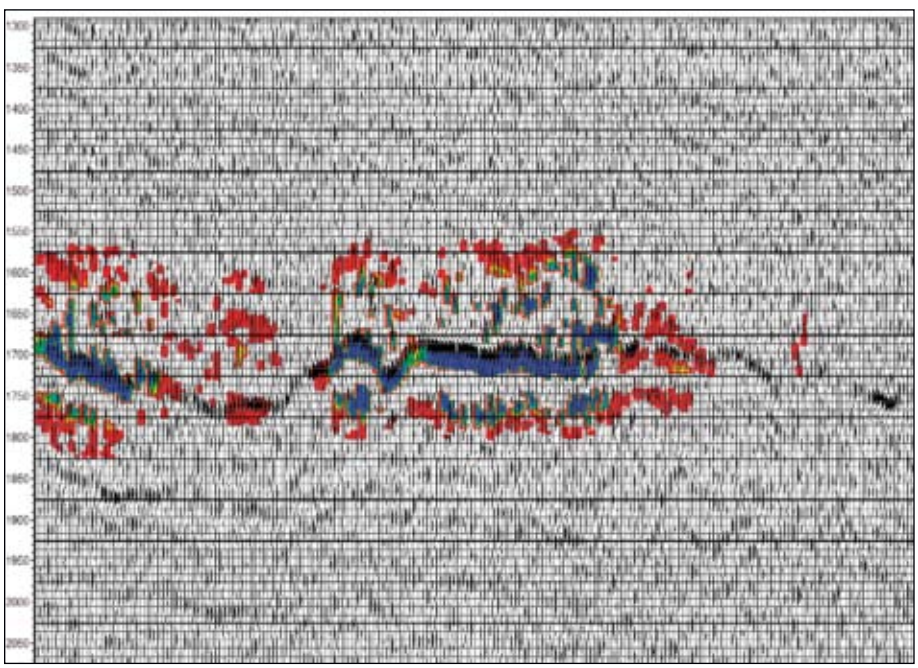


Formations that are water saturated or with low hydrocarbon saturations generally show a small CSEM response; commercially exploitable hydrocarbon deposits in general have a higher resistivity and correspondingly stronger CSEM response. Of course the presence

THE CSEM PROCESS

Fig. 1





Semiquantitative gas saturation estimate superimposed on the seismic wiggle traces. Blue represents high gas saturation, and reds are low saturation on the Nuggets-1 reservoir, UK North Sea (Fig. 2).

of other resistive features, such as tight limestones or volcanic structures, can complicate the interpretation.

In all cases a presurvey assessment is made to determine whether or not a CSEM survey is appropriate, and the design of the survey must take into account what that assessment reveals. The data collection is relatively straightforward, and the real value comes in the processing and interpretation.

Dr. Lucy MacGregor, chief scientific officer with OHM, said, "This is not a one-size fits all process. Each survey must be carefully planned, taking into account the survey objectives, to ensure that the optimum dataset is collected. Postsurvey, we take great care in the analysis and interpretation to arrive at a geoelectric section or volume, providing intuitive images that the client can usefully use in their exploration process."

The CSEM method offers exploration companies the opportunity to distinguish between water-filled and hydrocarbon-filled formations, as well as to determine the size and extent of the hydrocarbon-bearing structure. It can also provide extremely valuable information on the level of gas saturation, overcoming a pitfall in the seismic method that gives a seismic amplitude response at even very low, noncommercial gas saturations.

OHM's advanced processing techniques produce detailed images of the location of resistive bodies than can lead explorers to identify locations of hydrocarbons. With CSEM, the subsurface geoelectric structure is revealed.

How CSEM works

A high powered electromagnetic source is towed through the water transmitting a low-frequency signal to the seabed, and electromagnetic receivers placed on the seabed detect the resulting signal at offsets of up to 10-15 km.

Data are interpreted in one, two, and three dimensions through a combination of geophysical inversion and imaging, to provide geoelectric cross sections and volumes, and hence to map complex reservoir structures in subsurface structures anywhere from a few meters to several kilometres depth (Fig. 1).

Traditionally, CSEM surveys were limited to more than 300 m of water because of the interaction of the transmitted signals with the air in shallow water (the "airwave problem"). Research at OHM funded by a consortium that included Total, BG, Shell, Eni, and Chevron, with UK's Industry Technology Facilitator has largely removed this limitation.

This work culminated in a successful trial on the Nuggets-1 reservoir in the UK North Sea in summer 2005 in 116 m of water, demonstrating that CSEM data could be collected in water shallower than previously thought possible.

Commercial surveys have now been completed in 70 m of water, and surveys are planned soon in even shallower water.

The methods developed have been applied to real exploration problems. In February 2006, OHM completed two surveys for Rockhopper Exploration, a company focused in the remote North Falklands basin in the South Atlantic east of Argentina. The surveys were conducted in 110-140 m of water over an untested play concept in a basin with no current production and a reputation for extremely high drilling costs.

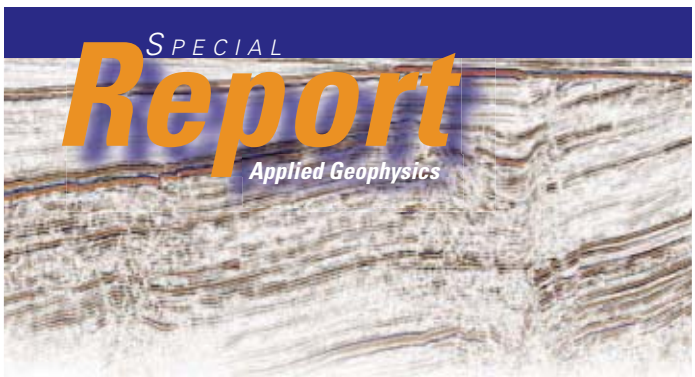
Preliminary results of the surveys indicate the presence of resistors, which when combined with the existing seismic data, give a positive indication of hydrocarbons.

A number of other commercial surveys have been completed, all of which have achieved the survey objectives and given useful information on the presence and extent of hydrocarbons.

OHM has operated extensively in deep water clastic basins off West Africa. Surveys have also been successfully conducted in more complex geology off Brazil; in complex stratigraphic trap plays in Southeast Asia, and in technically challenging imaging conditions in the Gulf of Mexico.

Surveys off Northwest Africa have examined traps bounded by diapiric salt, and recent shallow surveys in the Falkland Islands have successfully imaged resistive bodies in settings with complex basement topography. Multiclient CSEM surveys in West Africa and off Norway are selling well and have sharply derisked investments committed by oil companies in bid rounds.

Falklands Oil & Gas, also active in the North Falklands basin, recently selected OHM to acquire CSEM data over many of its larger prospects identified from seismic interpretation. The CSEM data will be used to reduce exploration risk and focus attention on the best prospects for drilling. The work will start in late 2006.



It seems that the largest oil companies are taking notice of this technology that is proving to be as revolutionary as 3D seismic was 25 years ago. In the August issue of the Society of Exploration Geophysicists magazine, "The Leading Edge," ExxonMobil and Shell submitted separate articles commenting on the importance each company places on CSEM for imaging subsea-floor resistivity structure.

Long dipole receiver is deployed from an acquisition vessel at the start of a controlled source electromagnetic survey. Photo courtesy of Offshore Hydrocarbon Mapping PLC.

Exploring synergies

Imaging sea-floor resistivity structure, however, is only the first step towards quantifying the properties within a reservoir and surrounding strata.

The CSEM method is powerful in itself, but it provides only one part of the picture. By bringing together a number of complementary geophysical techniques, the strengths of each can be exploited to better constrain the properties of the rocks and fluids within.

OHM has been working with Rock Solid Images Co., a private Houston concern, to develop the first-ever system that incorporates seismic, CSEM imaging, and well-log data to reduce exploration risk.

Although in the early stages of development, the techniques developed have been applied to data from the Nuggets-1 reservoir to show that through the combination of CSEM, seismic, and well-log data, gas saturation across the extent of the reservoir can be mapped (Fig. 2).

Where in the past CSEM was the domain of oil majors, we are now seeing the technology being used by midsize and junior exploration companies whose managements and shareholders recognize the value of reducing exploration risk—and therefore cost—using CSEM.

The technology is a powerful tool by itself. When combined with other geophysical technologies, CSEM offers exploration companies the chance to make better decisions and ultimately the potential to sharply reduce the risk of drilling dry exploration wells.

Extensive investment in research at OHM has improved signal to noise ratios by more than one hundredfold since the company's founding in 2002. This has greatly enlarged the

number of plays to which the technique can be applied through innovations like salt proximity imaging and technical breakthroughs like the shallow-water solution.

Although at present used largely in exploration and appraisal, the technology can be applied to reservoir monitoring and management applications.

With companies such as Falklands Oil & Gas, Rockhopper Exploration, and supermajors such as Shell, ExxonMobil, and Chevron vocally supporting CSEM and its integration with seismic technology, the question very soon might be, "Is there a business case for exploration without a CSEM survey?" ✦

The author

Dave Pratt (info@ohmsurveys.com) is chief executive officer with Offshore Hydrocarbon Mapping PLC, Aberdeen, Scotland. He has more than 20 years' experience in the oilfield service industry and was formerly president of Veritas Geophysical Services. He was vice-president of marine operations and technology for Digicon Geophysical Corp. Before that he spent more than 10 years at Racal Survey Group. A geophysicist, he has an MBA with distinction from the University of Strathclyde Graduate School of Business.

New ERD projects target 40,000 ft and beyond

Nina M. Rach
Drilling Editor

New extended-reach drilling projects are driving the development of innovative technologies and changing operating practices.

BP PLC is funding the design of a new land rig that can drill to 40,000 ft on the North Slope and Statoil ASA is planning to overhaul three platforms and begin extended-reach drilling at Gullfaks in 2007. Royal Dutch/Shell will also drill an extended-reach development well in the UK sector of the North Sea from one of its existing platforms.

Technology-savvy operators have used extended-reach drilling around the world, beginning with BP's successful Wytch Farm wells in 1995 (Table 1). Other European ERD projects include: RWE-DEA AG's wells from the Mittelplatte rig in northern Germany; Maersk Olie og Gas AS in the Dan field off Denmark; Statoil in the Sleipner field and Norsk Hydro AS in the Oseberg field off Norway.

In Asia, ERD successes have attracted enough attention to warrant a separate conference, in Kuala Lumpur in November 2005:

- Frank de Lange and Jack Pearse, engineers from Shell Todd Oil Services (STOS) discussed risks and best practices drilling New Zealand's longest wells at the Pohokura field, off the North Taranaki coast.
- Magne Heggoe, drilling superintendent for ConocoPhillips China, presented best practices for ERD in the Xijiang field in the South China Sea. ConocoPhillips has set records in the Xijiang 24-3 field, and the successes are particularly notable because some were drilled before rotary steerable technology was commercially available.
- Tang Hai Xiong, drilling department manager, and Wei Hong An, technology supervisor for China National Offshore Oil Corp. Ltd., explained how ERD extended the life of CNOOC's Lihua field in the South China Sea (OGJ, Aug. 1, 2005, p. 35).
- Yap Yun Thiam, drilling engineer for Petronas Carigali Sdn. Bhd., reviewed the planning and execution of the Angsi A-28ST1 well, Malaysia's longest well.

Woodside Energy Ltd. has used ERD to develop the Goodwyn field in Australia. The company switched from invert-emulsion drilling muds to ester-based drilling muds for its extended-reach wells a few years ago because they provided better lubrication to reduce torque and drag.

ERD is not widespread in South America, although Total, as operator of the Consortium Cuenca Marina Austral, drilled very long ERD wells in the Ara and Kaus fields off Tierra del Fuego in Argentina. In 1997-98, Total drilled six extended-reach wells from the Alfa Sur onshore base into the Ara West field, 6-10 km offshore. Halliburton assisted in the Cullen Norte well, drilled in 1999, with a 34,850-ft horizontal displacement.

Challenges

Operators choose ERD to reduce the environmental impact and costs of installing additional platforms or building artificial gravel islands.

But extended or extreme-reach wells must be designed to overcome the drag and friction on drill pipe and casing posed by long, horizontal sections.

Drilling rigs must have the power and hook-load capacity to handle the weight of long drill strings and a robust hydraulic system with sufficient pump capacity to provide and process large fluid volumes. Rigs drilling record-length wells often have four, 1,600-hp pumps.

Longer drilling times in ERD mean that the borehole is exposed for a longer time, leading to potential hole instability. Drilling equipment and operating procedures should be modified to reduce drilling and open-hole time.

Increasing rig efficiency with automated systems and the ability to take

The Orlan platform, operated by Parker Drilling crews, was used to drill extended-reach targets off the coast of Sakhalin Island for the Sakhalin-1 Consortium . (Fig. 1; photo courtesy of Exxon Neftegas Ltd.)

repetitive jobs out of the critical path will increase drilling speed and reduce overall rig time, making these wells even more cost-effective.

North Sea

Shell plans a single ERD well for the Barnacle field in UK Block 211/29 of the North Sea, drilling from the Brent Delta platform, Offshore247.com reported in August. The Barnacle field was discovered in 1992 with the 211/29-10 well and lies 4.75 km (about 3 miles) northeast of the Brent Delta platform.

Energy Development Partners will operate the block for Shell and spud the ERD well in November. EDP plans to drill the well "as a sidetrack of the existing BD 46 well, which is currently suspended and will be abandoned by Shell" prior to beginning the Barnacle sidetrack. EDP expects about 80 days of drilling, with first production anticipated in January 2007.

In 2004-05, Statoil ASA drilled a record length extended-reach well in the Visund field from a floating production and drilling platform in the Tampen area of the Norwegian North Sea. Odfjell Drilling AS drilled the 3⅛-A-6 AHT2 well to a measured depth of 9,082 m (29,797 ft) with a horizontal displacement of 7,593 m (Table 1).[1]

The A-6 well was 819 m deeper than the previous longest reach extended-reach well, the A-22, which was drilled in the same field in 2003. The A-6 well used a full length, intermediate sized 5⅞-in. drill string, rather than the conventional tapered drill string incorporating several pipe sizes that was used in the A-22 well.[2]

Advantages of using the monobore string include: quicker running and handling speed; smaller handling tool inventory and less maintenance; reduced surface pump pressure and maintenance; lower drill string weight; and a large cost savings from the increased drilling speed.[2]

Statoil's Visund team envisions drilling 12-14 km wells from Visund into the furthest extremities of the field.

Statoil also plans to use extended reach drilling at another northern North Sea field–Gullfaks. At the recent Offshore Northern Seas (ONS) conference in Stavanger in August, Statoil's Lars Christian Bacher said the company plans to use ERD at Gullfaks.

Statoil will modify three platforms and begin a 20-year exploration and development program with four extended-reach exploration wells in 2007. The wells are on the periphery of the Gullfaks area, near the Epidot and Alun discoveries.

Statoil, Halliburton Corp., and Prosafe Offshore Ltd. have already been successful using underbalanced techniques to improve drilling performance from the Gullfaks C platform in summer 2004.

Bacher said Statoil expects the ERD program to increase Gullfaks oil recovery to 69%.

Sakhalin

Exxon Neftegas Ltd. (ENL) operates for the Sakhalin-1 consortium, which is developing three fields: Chayvo, Odoptu, and Arkutun-Dagi, with total anticipated recovery of 2.3 billion bbl of oil and 17.1 trillion cu. ft of natural gas.[3]

The Chayvo field development plan includes 10-15 onshore extended reach drilling wells with reaches of 8-10 km, drilled from land into the Sea of Okhotsk, and about 18 offshore directional wells drilled from an ice-resistant platform.

Chayvo onshore ERD operations began in July 2003 and 10 of the planned land-based ERD wells were drilled by mid-2005 with the Yastreb drilling rig (OGJ Online, July 13, 2005). Additional Chayvo wells are being drilled from the Orlan concrete island in about 15 m water depth (Fig. 1).

The Chayvo wells had ERD ratios of nearly 4, with a maximum length of 33,406 ft, and horizontal displacement of 30,335 ft (Table 1).

Engineers from ExxonMobil Development Co. believe that the next generation of ERD at Sakhalin will benefit from improvements discerned from Chayvo drilling.[4] These include:

- Using redesigned completions, with stand-alone screens (SAS), pre-

SELECTED ERD MILESTONES

Table 1

Operator	Well(s)	Field	Location	Date	Measured depth, ft	Horizontal displacement, ft	ERD ratio*
Exxon Neftegas Ltd. (ENL), for the Sakhalin-1 consortium	Chayvo	Chayvo	Northeast Sakhalin Island, Sea of Okhotsk, Russia	2003-2005	30,758	27,621 30,335	3.59 3.90
Statoil ASA	34/8-A-6 AHT2	Visund	North Sea	2004-2005	29,797	24,911	
Shell Offshore. Inc	A-9	Ram Powell	Viosca Knoll Blocks 956-> 913, Gulf of Mexico	2004	25,400		2.19
China National Offshore Oil Corp. Ltd. (CNOOC)	C02ST1, A4ERW3, and B3ERW4	Liuhua 11-1	South China Sea Block 24/09	2003-2004			4.58
Hibernia Management and Development Co.	B-16 36 (OPA1)	Hibernia Block A	Grand Banks, Newfoundland	2003	30,698	23,728	2.36
BP Amoco PLC and CNOOC	A2ERW1 and D5ERW2	Liuhua 11-1	South China Sea Block 24/09	2002			3.89
RWE-DEA AG	Dieksand 5	Mittelplate	Germany	2000-2001	29,511	26,725	
BP Exploration & Production Inc.			Gulf of Mexico	2000	25,709	22,056	2.61
BP Exploration PLC	M-16Z	Wytch Farm	Dorset, England	1999	37,001	35,196	6.89
ConocoPhillips, Royal Dutch/ Shell, and CNOOC	A-14 (first of 13 ERD wells)	Xijiang 24-3	South China Sea	1997	30,308	26,446	
BP	M-5	Wytch Farm	Dorset, England	1995	28,592	26,361	5.43

*Extended-reach drilling ratio of measured depth to vertical depth; generally greater than 2.
Data reported by operators.

drilled liners, and well packers.

- Running improved rotary steerable systems that measure and manage vibration.
- Using drill bits designed to minimize overall overall drill string torque.
- Running conventional mud-filled casing.

The built-for-purpose Yastreb rig was designed by Houston-based Parker Drilling Co. to support extended-reach drilling and resist earthquake tremors (OGJ, June 17, 2002, p. 41). Skid rails are attached to driven pilings and the drilling module is clamped to the rails. The rig also features a compliant mast design. It has a fully enclosed and insulated pipe barn and derrick, a high-torque top drive, four 1,600-hp mud pumps, and high-capacity shale shakers.

Liberty then

The Liberty project in the Beaufort Sea is getting a fresh look. BP Exploration Alaska Inc. (BPXA), a division of BP PLC, drilled the Liberty discovery well in Federal waters on the outer continental shelf in February-March 1997. BPXA used the Pool Arctic Alaska (PAA) No. 4 rig to drill from the Tern gravel and ice island in 21 ft water, about 20 miles east of Prudhoe Bay.

Liberty No. 1 was the second to last well drilled in the Beaufort Sea. The last well was Warthog, drilled by Arco Alaska Inc. in November-December 1997, with the Glomar Beaufort Sea No. 1 rig in 35 ft water.

BP initially attempted to develop Liberty from an artificial gravel island, submitting and revising development and production plans beginning in 1998.

In January 2002, BP announced that it was putting the Liberty project development on hold, and in March 2002, it notified the MMS and other agencies that they should suspend processing of applications, pending revisions. In May 2002, the US Minerals Management Service issued the final environmental impact statement for the Liberty project, based on BP's initial plans. BP had proposed three alternatives: building Liberty Island about 5 miles offshore; using the existing Tern Island; or building Southern Island.

Liberty now

Now BP is evaluating extended-reach drilling in the Liberty field from a shore-based drilling site (OGJ, Nov. 7, 2005, p. 8).

Extended-reach wells planned from a Liberty land site would greatly expand the BP "drilling envelope" with equivalent departures beyond 40,000 ft and total vertical depth of about 11,500 ft.

BP's record-length departure is currently the M-16Z well in the Wytch Farm field, drilled to 37,001 ft MD with a horizontal displacement of 35,196 ft in 1999 (Table 1). The well had an ERD ratio (measured depth to vertical depth) of 6.89; the highest ERD well drilled to date, worldwide. (Recent Chayvo wells approach the two longest Wytch field wells in length, but the Chayvo wells are deeper, nearly 8,000 TVD.)

In early August, Parker Drilling announced that it was selected by BP to design a new drilling rig for the Liberty project. One design requirement is that the rig must be able to drill wells out to 8.3 miles (43,824 ft), a distance not yet attempted. "If the rig is built,"

Parker says, it will be the "largest in the world and drill the longest wells in the world." ✦

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Quality assurance lessens core, log data uncertainties

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Quality-assurance procedures can lessen the uncertainties inherent in core and log data. Elimination of these uncertainties will help optimize the development of oil and gas fields.[1]

Uncertainty means that a variety of outcomes may occur. The final result may be greater or less than expected. In the petroleum industry, deviations from expectation may have serious financial consequences.

Despite its importance, considerable confusion exists as to the best practice for calculating uncertainty. Making a decision on uncertain data alone is insufficient. The decision requires estimating all parameters contributing to the uncertainty and then adding them together in a way that displays the confidence level.

Quality assurance

In the last few years, quality control has increased its importance because of several factors.

First, competition has increased and, as a result, customers have more choices. Second, more and more companies have implemented quality-improvement programs that involve suppliers. The result from both these factors is that customers are more likely to define and measure the quality of products and services they receive.[2]

A concise definition is that quality is meeting specified requirements as agreed upon with the customer. Two important words in the definition are "specified" and "customer." Without specified requirements, one cannot measure quality. Also without defining the target or customer of the product or service, one cannot define the associated requirements or measure the conformance to those requirements.

Three important terms to define are:

- Quality control.
- Quality assurance.
- Total quality management.

With well cores and logs, quality control is an unpopular activity of checking the conformance of a given product to previously defined specifications. This quality control is undertaken after the fact and cannot improve a product or service; however, it can improve future logging efforts.

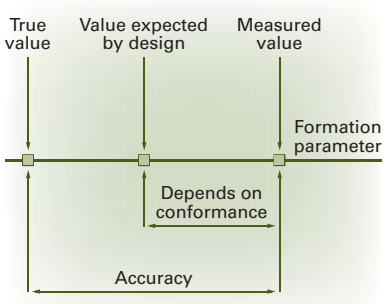
Quality assurance is a systematic approach to ensuring that a given process is adhered to consistently. Quality-assurance systems provide customers with confidence in the products and services they purchase. ISO-9000 is one such international system.

Total quality management is a business philosophy that seeks to release the organization's potential to identify and eliminate customer problems, enhance business processes, and increase customer satisfaction. Total quality management involves active participation of all personnel including subcontractors and is critical to the success of any business.[3]

Logging companies provide a concrete and specific product, information, or data. A log is a product that needs quality attributes. The product provides measurements that differ from the true value of the formation. This difference is called accuracy (Fig. 1).

Logs cannot match completely the user's requirements at the design stage. In addition, the product delivered in the field does not fit strictly with the one designed in research and engineering centers (Fig. 2).

MEASUREMENT ACCURACY Fig. 1

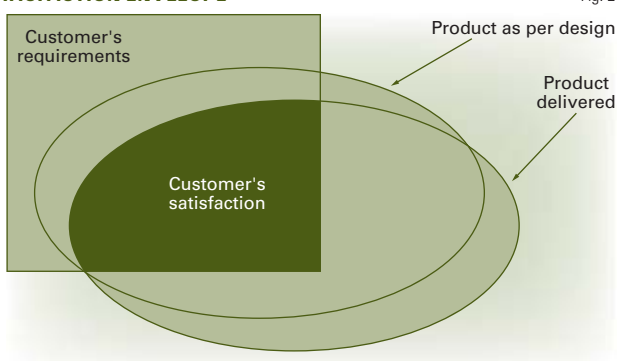


Note: Oil and gas companies require true value but well logging companies provide the measured value.

Core data

The key factors in determining core data quality are similar to those for any other product and include effective assessment of needs, effective communication, effective planning, and effective

SATISFACTION ENVELOPE Fig. 2



delivery of a "no-hassle" product.

The analysis must clearly define strategies for taking core plugs. Taking plugs on a rigid statistical basis every foot to avoid selection bias yields measurements on long sections of nonreservoir rock and measurements on heterogeneous plugs having mixed lithologies and crossbedding.

Cores provide an understanding of the reservoir rock and can calibrate the porosity derived from logs such as density. One question is why spend money to measure nonreservoir rock? It is much better to cut good quality plugs in potential reservoir rock. The average properties are then correct for the net column but not for the gross column.

The choice of a core analysis contractor is important because different laboratories will obtain different answers for the same type of measurement on the same rock.

Steps taken by the industry to standardize the results range from recommended practices to test plugs and more recently to the adoption and accreditation of quality management.

A useful alternative to these steps would be a more widespread use of laboratory check plugs. These provide a representative quality statement about the laboratory.

A wide variety of related but different experiments derive the required core parameters. Each test has both positive and negative attributes. Effective communication of these attributes is essential for making informed choices.

Before an analysis, a major factor in acquiring good core data is a critical assessment of how representative are the samples. For example, X-ray visualization techniques can ensure that plugs are cut in the correct orientation and are free of unrepresentative features or misoriented permeability barriers that can affect flow out of proportion to their influence in the reservoir.

The assessment of X-ray images of cores enables the nondestructive evaluation of intervals for subsequent core analysis measurement. The technique allows for the identification and avoidance of man-made artifacts.

Information on representative features enables informed sampling for core analysis.

Core quality assurance

Cores often provide the only direct measurements of reservoir properties. The measurements indicate hydrocarbon presence and distribution, storage capacity (porosity), and flow capacity (permeability), such as:

- Porosity, permeability, residual fluids, and lithology.
- Areal changes in porosity, permeability, and lithology required to characterize the reservoir.
- Irreducible water saturation or residual oil saturation.
- Unaltered wettability or saturation state.
- Directional permeability.
- Calibration or improved interpretation of logs.
- Depositional environments.

The industry often undervalues core information because of the perception that the quality of the data is limited. Many end users of core-analysis data have examples where the laboratory has not met the quality requirements. Typical problems that result in unrepresentative data are:

- Unsuitable preservation and sampling procedures.
- Sampling bias.
- Out-of-calibration test equipment.
- Not following standard procedures or nonexistant standard procedures.
- Insufficient training of laboratory personnel.
- Not communicated or understood end-user requirements.

Some reasons for these problems include:

- Reliance on quality control instead of quality assurance.
- Lack of or availability of industry standards.
- Poor communication between the customer and laboratory in understanding each other's requirements.

Organizations such as the Society of Core Analysts, a chapter at large of the Society of Professional Well Log Analysts (SPWLA), and the American Petroleum Institute (API) provide recommended practices that play an important role in opening up communications within the industry, improve the understanding of the role of core analysis, and generally contribute to better core analysis.

The efforts of these groups should continue, but at best they only can provide guidelines and recommendations.

Quality-assurance programs in the form of ISO 9000 and BS5750 can also improve data quality by ensuring improvements in the operation of laboratories and the procedures used.

Quality assurance, control

A common method for checking core-analysis data has been for companies to send sets of check samples to various laboratories. The laboratory runs the test and returns the data for comparison with the "correct" results.

The value of this quality-control check is limited. Apart from perhaps a laboratory taking extra care to ensure good data, the client does not have a guarantee that the samples run on different equipment or by a different operator would provide the same results.

An additional problem arises if the test conditions are not specified. For example, a gas-permeability test can be taken at different confining pressures with varying mean pressure and the results will vary accordingly. All the results will be correct for the given test conditions.

A quality-assurance system ensures that laboratories run data on maintained and calibrated equipment, according to documented procedures with fully trained personnel. This system gives the customer greater confidence that the data are correct every time and that they clearly define the test conditions.[4,5]

Fit-for-purpose data

Because data requirements change during the life of a field, they require fit-for-purpose data. This involves the determination of the quality required for the type of data, its accuracy and precision

requirements, and the quantity required at different stages of field life

Because every field is different, fit-for-purpose data requirements vary from field to field and even from reservoir to reservoir within a field. Fit-for-purpose data during a field's life cannot be put into a simple checklist of log, core, and pressure, and flow tests on specific wells on specific dates.

Adequate reservoir characterization requires representative reservoir data. A difficulty arises when it is unclear whether a problem is a data-related issue or whether the interpretation is incomplete.

Sensitivity analyses can quantify the impact of potential errors. A measurement of whether a valid interpretation of good data has been made is the comparison of predicted vs. actual production and pressure responses. When they match, it is reasonable to conclude that the analysis has provided a valid reservoir description. Thus, the analysis does not require any more of this type of data.[6]

Aspects that frequently require attention for a successful development include data coverage (x, y, z) and quantity; dynamic and static data; data quantity (accuracy and precision); and integration and reconciliation of different measurement scales.[7]

The accompanying box lists the details.

Log interpretation uncertainties

In addition to the most likely value of hydrocarbons in place, the reservoir engineer needs to know the uncertainty of this value.

Two methods for quantifying uncertainties propagated from log data

Fit-for-purpose data

A successful development plan requires that attention be paid to data coverage (x, y, z), dynamic and static data, data quality, and integration and reconciliation of different measurement scales.

Data coverage (x, y, z) and quantity involve knowing if the data:

- Capture and describe reservoir heterogeneity and flow unit continuity.
- Are from crestal or downdip wells.
- Include aquifer data.
- Include wells with sufficient spacing to ensure that field characteristics distinguish different scales (geologically, petrophysically, and hydraulically) and allow for the construction of meaningful maps.
- Include 3D seismic.
- Solve the problems of geophysicists, reservoir geologist, and reservoir and simulation engineers.
- Indicate the validity of single-field wide values for cementation and saturation exponents.
- Provide sensitivity parameters for estimating reserves.

Dynamic, static data include:

- Acquiring data for reservoir management purposes during the field life to monitor such parameters as pressure depletion, fluid movement, water breakthrough.
- Determining if net cutoffs for one part of a field are relevant to other parts and flow units in the field.
- Verifying if spinner surveys evaluated the net-to-gross pay cutoffs.
- Determining if net-to-gross cutoffs evolved based on production data during field life and their impact on reserves estimates.
- Obtaining formation pressure data and determining if some reservoir zones deplete faster than others and if this was predicted.
- Determining if baseline pulsed-neutron decay logs were obtained.
- Determining if permeability studies yield adequate correlations with well-test results.

Data quality includes:

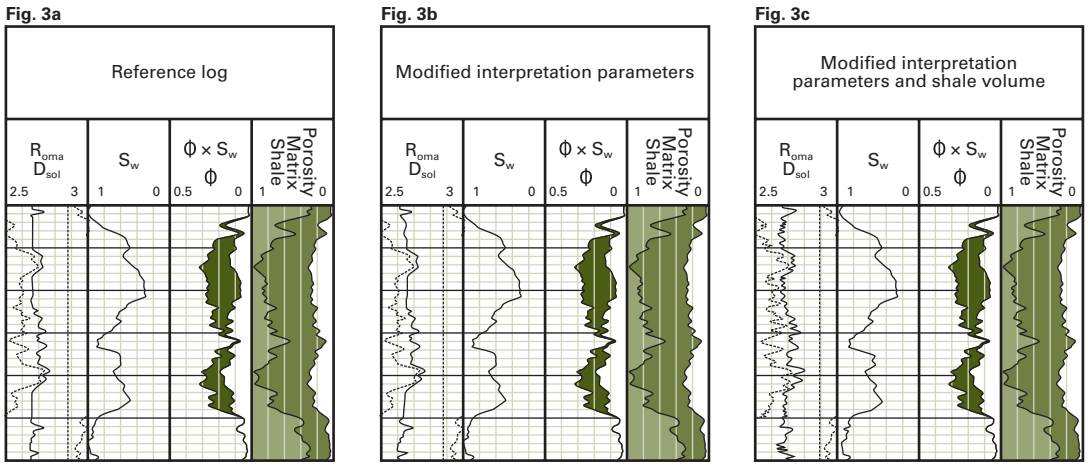
- Determining the precision and accuracy needed for different parameters.
- Forecasting the accuracy and precision needs (and hence cost) during field life. This may involve more expensive as well as cheaper techniques and data.
- Identifying any problems in early wells subsequently solved by modifying data acquisition programs.
- Evaluating if the field model is cohesive and reasonable.

Integration and reconciliation of different measurement scales require:

- Determining if the value of the money spent for integrating data types and the criteria for determining the value.
- Reconciling the different scales of measurement.
- Determining if the vertical density and resolution of data were considered, such as minipermeameter, core plug, and well tests.
- Integrating flowmeter surveys with data from image logs, conventional openhole logs, core permeability for evaluating such parameters as net-to-gross pay.
- Determining whether disagreements in datasets are a problem of data quality or the quality of its interpretation.

MODIFIED LOG INTERPRETATION

Fig. 3



R_{oma} - Resistivity matrix, D_{sol} - Density solids, S_w - Water saturation, Φ - Porosity

are: the Monte Carlo method, which requires a few lines of programming but has a long computation time, and an analytical solution, which requires a sophisticated program but has a short computation time.

These analyses estimate the dispersion of the results caused by random and sampling errors. The deviation from the true value, caused possibly by systematic errors, is not considered.

A decision concerning a field appraisal or development process must account for the economic risk connected to the uncertainty of hydrocarbons in place.

Although most log interpretations only provide the most likely petrophysical parameter values, the reservoir engineer also needs to know the uncertainty for these values. A log interpretation should therefore provide, in addition to the usual results, the uncertainties for these values.[8 9]

Three different ways of managing uncertainties are:

1. Perform sensitivity tests on each source of uncertainty to determine those with the greatest effect and improve their determination and acquisition.

2. Interpret each option or at least indicate the alternative options, when the results indicate several possibilities.

3. Compute the final uncertainty derived from all known uncertainties of the data so that the reservoir engineer can take these into account in the evaluation. Uncertainties include:

- Uncertainties on the recorded logs. Logging vendor information usually does not permit quantification of these uncertainties. This point may be taken into account or might be negligible compared with the other uncertainties on the logs.
- Environmental corrections. Most input parameters for environmental corrections are rough estimates, and the equations are often approximate, even though the correction factors obtained with equations might be large.

For example, in a 12¼-in. borehole diameter, the log analysis must correct the neutron-derived porosity log for an approximate standoff effect, which depends on the exact position of the tool in the well.

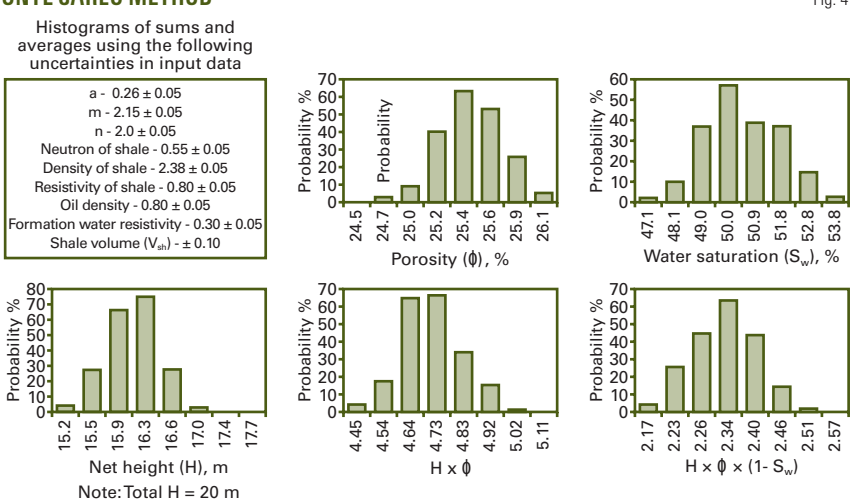
If standoff varies between 0.0 and 0.5 in., this correction leads to an uncertainty of about ±1.5 porosity units (pu).

Another example is true formation resistivity (R_t) and flushed-zone resistivity (R_{xo}) determined from a set of resistivity logs with the assumption of an invasion profile (generally a step profile). The uncertainties of the volumetric log response and the invasion profile approximation cause an uncertainty on saturations and also on the porosity, which depends on R_{xo}.

- Investigation depths. The different volumes of investigation by each tool will create interpretation uncertainties. Log interpretation provides results based on measurements with different

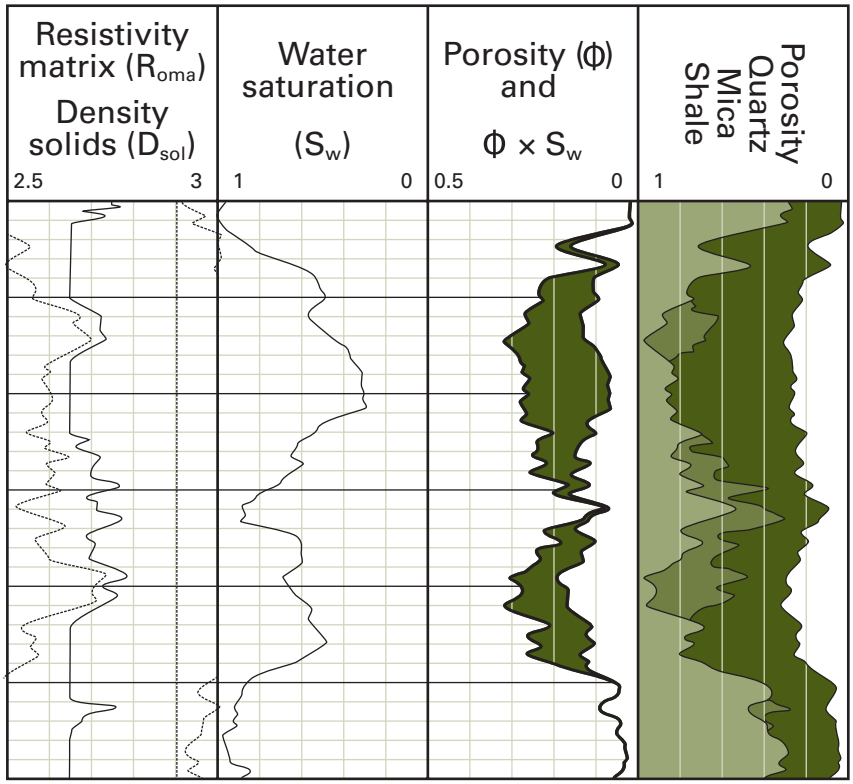
MONTE CARLO METHOD

Fig. 4



Analytical solution

Fig. 5

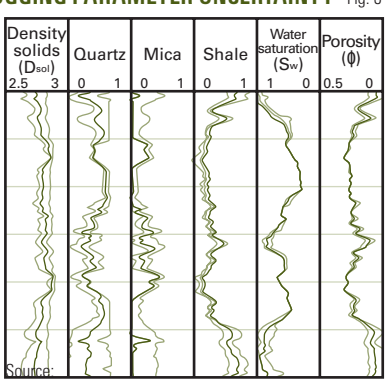


volumes of investigation (vertically and horizontally). These results, therefore, are valid only as an approximation and should include an estimated uncertainty.

- Equations used for the interpretation. The transform between logs and usable petrophysical parameters of logs, especially that of the sonic log and the neutron log, is not known completely. This also applies to saturation equations.
- Interpretation parameters. Different log analysts on the same set of data may provide different interpretations.

Logging parameter uncertainty

Fig. 6



Monte Carlo method

The Monte Carlo method involves a large number of interpretations each having different inputs for the log values as well as for the interpretation parameters. These inputs have random values inside a normal distribution centered on the reference values. The most likely interpretation defines the reference values (Fig. 3a).

Fig. 3b shows the interpretation modifying the parameters and in Fig. 3c, after modifying both the parameters and shale volume (V_{sh}) log. Fig. 4 then provides a computation of sums (porosity × height and hydrocarbon height) and averages (average porosity and water saturation). This leads to a statistics solution with these sums and averages to provide histograms and standard deviations.

The method requires a few lines of programming and a long computation time. The uncertainty is determined for the required intervals, not for each log sample.

This method uses a deterministic interpretation algorithm (n equations, n unknowns).

A log analyst can determine easily the uncertainty on the input parameters; however, the uncertainty on the log values must be estimated from previous experience.

This computation does not include the uncertainties in the log values.

Analytical method

The analytical method includes an optimization interpretation algorithm (n equations, m unknowns, n>m). As in the Monte Carlo method, the set of the most likely values of all interpretation parameters defines the reference solution. A standard interpretation process provides the results shown in Fig. 5.

An analytical solution computes a continuous curve of standard deviation for each output component (matrix, clay, and fluids). The porosity, water saturation, and solid density standard deviations are then computed as combinations between some components. Fig. 6 shows the logs of maximum and minimum values derived from these standard deviations.

This method requires a sophisticated program, but once written, the computation of uncertainties is fast and provides a value of uncertainty for each log sample (uncertainties could appear as curves).

For the Monte Carlo method, the log analyst easily estimated the uncertainty on the interpretation input parameters, but the analysis should have computed previously the uncertainty on the log values.[10] ✦

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Total drills first North Sea well with RMR

Total E&P UK PLC recently used riserless mud recovery (RMR) technology in a dual-gradient, top-hole drilling system to drill a well on the Jura West 3/15-10 prospect.

The recently completed well was drilled with the Sedco 714 semisubmersible rig in 113 m of water and Total was the first to use the new technology in the North Sea.

RMR technology was developed by Ability Subsea AS as a means of recirculating and reusing drilling fluids. Benefits of the technology include cost savings from reduced operating time and reduced environmental impact from avoided discharges to the sea. RMR allows for more controlled handling and disposal of drill cuttings.

Ability Subsea, part of Norway's AGR Ability Group AS, provides technology and services that extend the boundaries of offshore drilling, especially in geotechnically challenging and environmentally sensitive areas.

RMR technology was recognized in 2005 with a spotlight award at the Offshore Technology Conference (OGJ, May 9, 2005, p. 28). Ability Subsea initially tested the system in the Troll field off Norway and has been using it in the Caspian Sea.

The Azerbaijan International Operating Co. (AIOC), operated by BP PLC, was an early adopter of riserless, dual-gradient technology. In early 2004, BP gave AGR a 2-year, extendable contract to use the system for top-hole drilling in the Azeri field, to cope with shallow gas hazards in the Caspian Sea. Wells were predrilled for Phase 2 of the Azeri, Chirag, and deepwater Gunashli (ACG) field development plan, before the Central Azeri (OGJ, Nov. 1, 2004, p. 9) and East Azeri (OGJ, Aug. 21, 2006, p. 8) platform decks were installed.

In April 2006, Ability Subsea presented the technology in China at a drilling and well service workshop developed by INTSOK-the Norwegian oil and gas partners and Petrad, a non-profit Norwegian government foundation.

Ability had two RMR units operating in first-quarter 2006 and four units during second-quarter in the Middle East and in Russia. The company invested 50 million NOK in RMR equipment during the first 6 months of the year.

Total E&P UK PLC acknowledged a significant time savings over the previous technology used to drill similar 26-in. hole sections and regarded the implementation as successful. The company plans further deployment of the technology later this year.

Use of the RMR technology is spreading. It was recently deployed off Sahkalin Island and in the Barents Sea, where no drilling discharge is permitted. Other applications have been in areas of poor hole stability where an engineered fluid system is required. One of the main advantages of running the system, says the company, is the ability to push planned casing setting depths deeper and hence simplify casing design.

RMR has been deployed in water depths of up to 400 m and Ability Subsea has now commenced development work with two leading oil corporations to make the technology operational in water as deep as 1,500 m. The company plans field trials at these depths for next year.

In July, Shell Australia contracted with Ability Subsea to provide RMR services for its upcoming western Australian exploration. ✦

Riserless mud recovery (RMR) technology reduces pollution and environmental impact by controlling handling and disposal of drill cuttings (Fig. 1; photo provided by Ability Subsea AS).

New method improves back-allocation for gas, condensate at processing plants

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This article reports on development of a methodology for the back-allocation of natural gas and condensate at natural gas processing facilities. This methodology is based on energy and weight balance equations that use gas and condensate compositions in the inlet and outlet streams.

A case study in Khalda Petroleum Co. confirms the applicability of this work. The new allocation system has proven reliable and is a comprehensive solution to meet the requirements of Khalda back-allocation process. The system provides capabilities to compute production on points where accurate measurements are not physically possible or economically practicable.

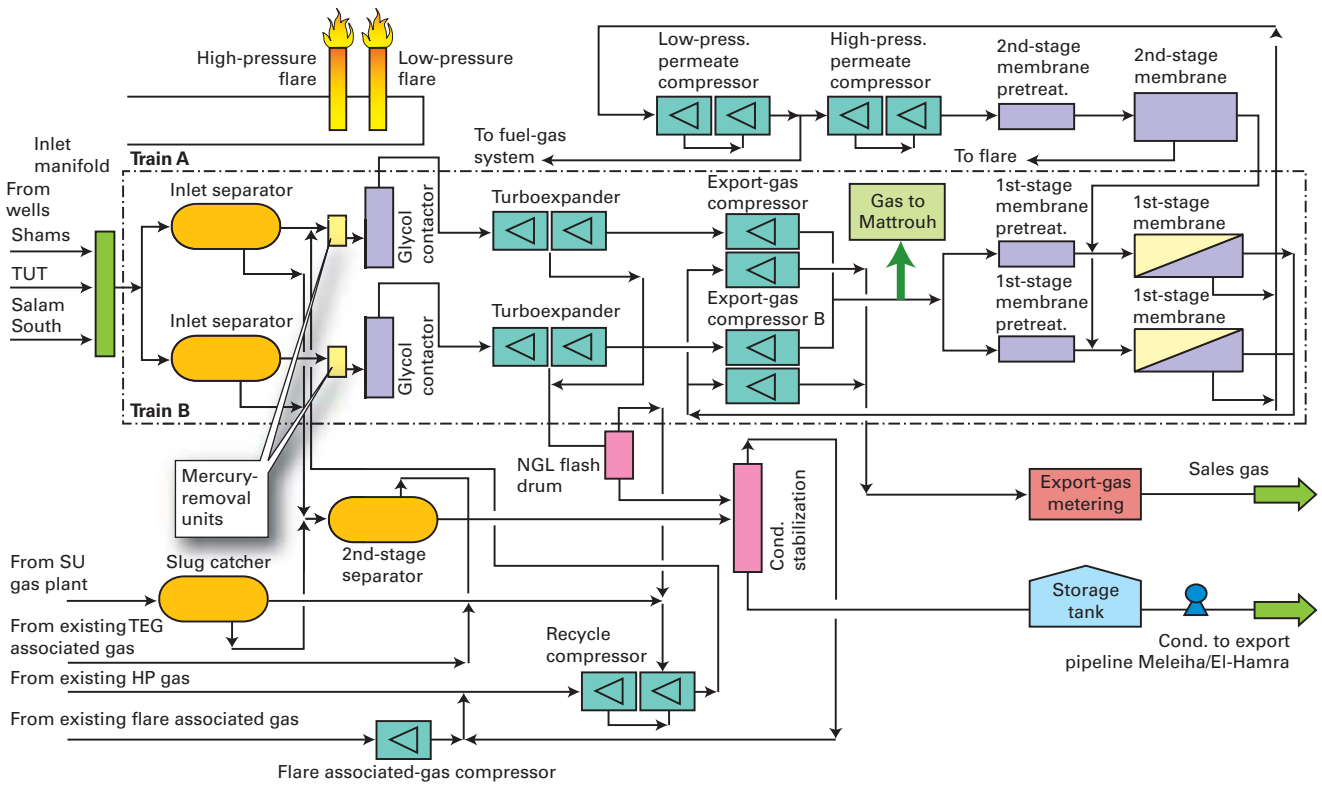
With natural gas production increasingly important to oil and gas companies in recent years, the problems of back-allocations to determine partners' and owners' shares of gas and condensate in the producing reservoirs have become more important. Several gas-balancing agreements are currently in use in the industry. Many of these agreements, however, fail to address adequately practical engineering problems encountered in balancing gas production.[1-6]

These problems include balancing of condensate production vs. balancing of gas production, owner's imbalance at the time of acquisition or sale, and nomination and allocation to pipelines and purchasers.

Traditionally, allocation has been done primarily on the basis of energy content.[7 8] This article, however, presents another methodology for allocation of

SALAM GAS PLANT

Fig. 1



the gas and condensate at natural gas processing plants, a methodology based on both energy and weight balance equations.

Equations

The energy-content method, or principle, of allocation is based on the fact that the petroleum industry is engaged in supplying energy in the form of heat.[7 8] The heat content of liquid and gaseous fuels supplied is, to a large degree, the measure of the real value of the material.

The energy content is, therefore, a good measure of the intrinsic value of the hydrocarbons being produced. The energy-content method has the advantages of simplicity and stability because the constant ratio of heat content can be used as the measure of energy produced.

The product entitlements can be calculated according to the respective contribution in the feed streams. First, the feed streams, contribution is obtained according to Equation 1 (see accompanying equations box).

Then, the product entitlements for each stream can be calculated according to Equation 2.

The export point can be defined as the starting point for back-allocation at natural gas processing facilities because that is where an accurate production measurement is taking place. The product entitlements can be calculated according to the respective contribution in the feed streams.

First, the feed streams, contribution expressed in weight fraction for each component is obtained according to Equation 3.

Then, the product entitlements for each stream can be calculated according to Equation 4.

Salam gas plant

Khalda Western Desert Gas Development Project at Salam is in the western desert of Egypt, 70 km from Matrouh.

Equations

$$SjCO = HSj/T \quad (1)$$

$$Sjz = SjCO * EzVFW \quad (2)$$

$$SjCO(i) = SjFW * Sjwt(i)/T(i) \quad (3)$$

$$Sj\ Ez = \sum SjCO(i) * EzMFW * Ezwt(i) \quad (4)$$

Nomenclature

EzMFW: Raw hydrocarbon mass flow rate of Stream z, tons/day
Ezwt (i): The weight composition of component i in Stream z, fraction
EzVFW: Raw Hydrocarbon volume flow rate of Stream z, MMscfd
HSj: Heat content of stream j, btu/day
i = 1, 2, 3....to n component
j = 1, 2, 3....to x feed stream
SjCO: Stream j contribution in the feed energy, fraction
SjCO (i): Stream j contribution in the feed for the weight of component (i), fraction
Sj Ez: Stream j entitlement from Stream z, tons/day
SjFW: Raw hydrocarbon flow rate of Stream j, tons/day
Sjwt (i): .The weight composition of component i in Stream j, fraction
Sjz: Stream j entitlement from the volume flow rate of Stream z, MMscfd
T: Total heat content in the feed, btu/day; = ∑ HSj
T(i): The total weight of component (i) in the feed, tons/day; = ∑ SjFW * Sjwt (i)
z = 1, 2, 3...to y outlet stream

The plant processes gas and condensate from five sources: Salam field wells, Qasr field wells, South Umbarka wells, and high-pressure gas and associated gas from a gas-oil separation plant.

The Salam gas plant produces about 200 MMscfd of export gas at an export pressure of 101 bara and 9,000 stock-tank bbl of condensate. The sales gas is designed to have a maximum CO_2 content of 3.0%, maximum H_2S content of 4 ppm (vol), heating value greater than 1,040 btu/std. cu ft, water dewpoint of less than 0.0° C. at 71 bara, and cricondentherm of 5° C. The condensate is designed for a maximum of 11 psi rvp.

As Fig. 1 shows, the gas from wells flows into two parallel trains. First it enters three-phase separator where the main water-condensate-gas separation takes places. The gas from the three-phase separators goes to a mercury-removal unit. Then, the gas flows to the glycol contactors to remove water from the gas to avoid hydrate formation and to achieve water dewpoint specifications.

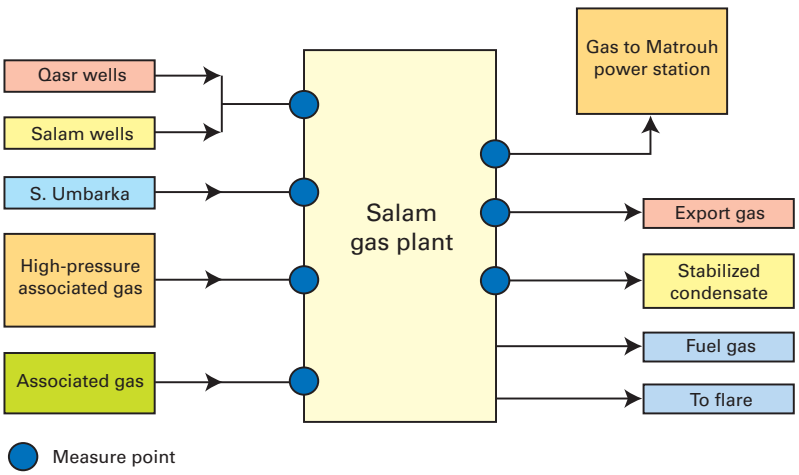
Gas is then diverted to the dewpointing package whose function is to separate the entrained traces of condensate and the heavier hydrocarbon, which condensed as liquids from the gas at lower temperatures. This step is done to achieve the hydrocarbon dewpoint specifications using the turboexpanders.

After dewpointing, part of the gas (about 9 MMscfd) flows to the Matrouh power station before entering the membrane system of the sweetening process. Currently, this gas is discharged to the Matrouh power station at 37 bar, 40° C., and about 1,200 btu. The rest of the gas enters the gas-sweetening system (membrane package) to reduce the CO_2 content of the export gas.

The final step is to export the gas in

MATERIAL BALANCE FOR SALAM GAS PLANT

Fig. 2



QASR, SALAM WELLS: TOTAL ENERGY OF GAS, CONDENSATE*

Table 1

Component	Gas	Condensate
	mol %	
N_2	0.53833	0.12375
CO_2	7.67667	3.00975
C_1	78.28833	11.71825
C_2	8.74667	6.66000
C_3	3.05000	6.32575
i-C_4	0.41667	1.72100
n-C_4	0.68667	4.06900
i-C_5	0.19000	2.42500
n-C_5	0.17667	3.00700
n-C_{6+}	0.23167	60.94050
Total	**100.00**	**100.00**
MMscfd	198.2250	9.37122543
Stock-tank bbl	—	9,984
Mol wt	21.2559	95.2760
Liq. sp gr	—	0.6708
Btu/std. cu ft	1,088	4,908
MMbtu	215,763.6064	45,991
Btu total, MMbtu	261,755	

*At inlet separators of Salam plant.

SALAM WELLS: DISTRIBUTION OF GAS, CONDENSATE PRODUCTION RATES

Table 2

	Test 1				Test 2				Conditions on Mar. 20, 2006				
Well	Date	Choke size, %	Well-head press., psi	Flow rate, MMscf	Date	Choke size, %	Well-head press., psi	Flow rate, MMscf	Choke size, %	Well-head press., psi	Flow rate (est.), MMscf	CGR*	Esti-mated cond., bbl
Salam-16	Aug. 2005	50	1,098	15.56	Sept. 2005	50	1,076	14.93	52	1,025	13.14	12	157.68
Kenz-1	Dec. 2004	38/64	1,097	2.32	Jan. 2005	38/64	1,100	2.15	38/64	1,050	2.00	35	70
Tut-25	Feb. 2006	61	1,195	33.12	Mar. 2006	58	1,167	32.86	55.4	1,146	32.67	6	196.02
Tut-50	Oct. 2005	33	1,045	10.64	Nov. 2005	37	1,027	9.08	41	1,020	8.47	16	135.52
Tut-52	Feb. 2006	60	1,025	12.62	Mar. 2006	61	1,011	12.59	61.4	1,000	12.57	6	75.42
Sh-2	Feb. 2006	47	1,170	6.84	Mar. 2006	50	1,150	6.49	49.9	1,160	6.00	27	162
Sh-4	Aug. 2005	67.6	1,257	30.98	Mar. 2006	75	1,257	28.39	66.1	1,235	30.00	3	90
Sh-7	Feb. 2006	59	1,150	4.19	Mar. 2006	59	1,157	3.67	54.9	1,145	4.00	34	136
Sh-9	Feb. 2006	65	1,240	20.58	Mar. 2006	65	1,244	20.52	60.9	1,222	20.00	4	80
Ozo-4	Jan. 2006	26	2,700	14.50	Feb. 2006	26	2,573	14.64	26.7	2,396	15.00	47	705
Tut-22	(Nodal wells) @ Mar. 20, 2006										6.735	59	397
Tut-40													
Tut-51													
Total												**150.585**	**2,204.64**

*Condensate-gas ratio.

the export pipeline, matching previously stated specifications.

Condensate collected from the various processing steps is transferred to the stabilization step before being stored in the three storage tanks. Stabilization removes the light hydrocarbons to avoid release in the tanks and to achieve the rvp specification. This step is carried out in the stabilizer tower. Condensate is then shipped from the storage tanks via shipping pumps to El-Hamra.

Back-allocation for Salam

The following actual example for the Salam gas plant allocation illustrates application of the allocation procedure just described. Fig 2 presents the material-balance block diagram for the gas plant, showing every stream and measuring point involved.

At the plant's inlet (Fig. 2) are connected the feed streams of Qasr and Salam wells. The gas or the condensate production rates for each field (Salam or Qasr) cannot be separately measured. The total gas and condensate rates of Salam and Qasr wells together, however, can only be measured with totalizers (198.225 MMscfd and 9,984 b/d).

Therefore, the first task in the calculations was to determine separately the gas and condensate production rates of Qasr and Salam at the inlet streams of the Salam plant using the energy-balance equations as described below.

1. Table 1 shows the calculation for the total energy of the gas and condensate produced from Qasr and Salam wells at the inlet separators of Salam plant. It is about 261,755 MMbtu.

2. Distribution of the gas and condensate production rates from natural Salam wells can be estimated with the results of the last production rate tests, as shown in Table 2.

3. Total energy of the gas and condensate produced from Salam wells can be calculated with the compositions data of the Salam wells, as shown in Table 3. It is about 175,466 MMbtu.

4. Total energy of the gas and condensate produced from Qasr wells can

SALAM WELL: GAS PRODUCTION, ENERGY RATES

Table 3

Well Date	Shams 9 Aug. 8, 2005	Shams 7 July 14, 2005	Shams 2 July 15, 2005	Shams 4 Aug. 11, 2005	Tut 50 July 9, 2005	Tut 25 Aug. 20, 2005	Tut 52 Sept. 13, 2005	Salam 16 Oct. 4, 2005	Kenz 1 Apr. 17, 2005	Ozoris 4 Oct. 27, 2005	Nodel wells Mar. 11, 2006
N_2	0.52	1.12	0.51	0.52	0.41	0.48	0.53	0.57	1.27	0.22	1.03
CO_2	7.18	6.7	7.29	7.29	7.35	7.68	7.64	7.28	3.42	5.21	6.91
C_1	83.93	72.31	74.7	83.38	74.85	78.61	79.57	77.49	76.51	71.99	63.95
C_2	6.37	12.08	11.35	6.54	11.42	8.83	8.68	9.61	11.84	15.36	13.56
C_3	1.43	5.03	3.8	1.57	3.76	2.77	2.47	3.29	4.53	5.21	8.7
i-C_4	0.18	0.64	0.51	0.2	0.49	0.4	0.31	0.43	0.61	0.51	1.23
n-C_4	0.22	1.08	0.86	0.26	0.82	0.61	0.46	0.7	1.03	0.93	2.59
i-C_5	0.01	0.27	0.23	0.07	0.22	0.18	0.01	0.18	0.26	0.19	0.68
n-C_5	0.01	0.25	0.23	0.01	0.22	0.14	0.03	0.17	0.23	0.21	0.66
C_6/C_{6+}	0.15	0.52	0.52	0.16	0.46	0.30	0.30	0.28	0.30	0.17	0.69
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
MMscfd	20	4	6	30	8.47	32.67	12.57	13.14	2	15	6.735
Btu/std. cu ft	1,020.33491	1,182.565	1,149.031	1,026.34	1,143.979	1,085.848	1,066.3096	1,105.189	1,189.525	1,204.397	1,329.40108
MMbtu	20,406.6982	4,730.259	6,894.186	30,790.21	9,689.505	35,474.65	13,403.511	14,522.18	2,379.051	18,065.96	8,953.516
Salam gas, MMbtu						165,310					
CGR	4	34	27	3	16	6	6	12	35	47	58.94580549
Stock-tank bbl/day	80	136	162	90	135.52	196.02	75.42	157.68	70	705	397
Mol weight	95.276	95.276	95.276	95.276	95.276	95.276	95.276	95.276	95.276	95.276	95.276
Liq. sp gr	0.6708	0.6708	0.6708	0.6708	0.6708	0.6708	0.6708	0.6708	0.6708	0.6708	0.6708
MMscfd	0.075	0.128	0.152	0.084	0.127	0.184	0.071	0.148	0.066	0.662	0.373
Btu/std. cu ft	4,908	4,908	4,908	4,908	4,908	4,908	4,908	4,908	4,908	4,908	4,908
MMbtu	368.5	626.5	746.3	414.6	624.3	903.0	347.4	726.4	322.5	3247.8	1828.9
Salam cond., MMbtu	10,156										
Gas and cond., MMbtu	175,465.991										

QASR SALAM WELLS: EQUIVALENT GAS, CONDENSATE PRODUCTION RATES*

Table 4

Total btu at Salam plant inlet, MMbtu	261,755
Salam wells, MMbtu	175,466
Qasr wells, MMbtu	86,289
Salam btu ratio	0.6703
Qasr btu ratio	0.32966
Total gas at Salam plant inlet, MMscfd	198.2250
Equivalent Salam gas, MMscfd	132.88
Equivalent Qasr gas, MMscf	65.35
Total condensate at Salam plant inlet, b/d	9,984
Equivalent Salam condensate, b/d	6,692.72
Equivalent Qasr condensate, bbl	3,291.28

*At Salam plant inlet separators.

be calculated as (the result of Step 2 less the result of Step 1), 86,289 MMbtu.

5. The equivalent gas-condensate production rates of Qasr and Salam wells at the inlet separators of the Salam plant can be calculated, as shown in Table 4.

After all the inlet streams at the Salam plan are identified, the back-allocation for sharing gas and liquid produced from Salam gas plant is calculated on the basis of components, contributions in the inlet streams.

The data (gas-condensate flow rates and compositions) of the inlet streams (high-pressure gas, associated gas, Sumbarka gas, Qasr wells gas, and Salam wells gas) and the data of the outlet streams (gas to Mattrouh, export gas, fuel gas, flared gas, and condensate) along with the weight-balance equations were organized (with mole fractions of each stream) to determine the allocation of the gas and condensate.

Excel spreadsheets have been prepared for the weight-balance equations to perform this task. The products-entitlement summary report obtained from these spreadsheets can be presented as shown in Table 5.

SALAM GAS PLANT: PRODUCTS ENTITLEMENT SUMMARY REPORT

Table 5

	Qasr, Salam wells	Qasr wells	Salam wells	S. Umbarka wells	TEG	High press.	Associated gas	Total
Inputs								
Raw gas, MMscfd	198.225	65.346	132.879	13.806	—	1.261	10.397	223.689
Raw condensate, stock-tank bbl/day	9,984.00	3,291.276	6,692.724					9,984.000
Weight, tons/day	6,100.922	2,011.201	4,089.721	335.191	—	36.820	385.570	12,959.425
Contribution (by weight)	0.88954	0.29324	0.59630	0.04887	—	0.00537	0.05622	1.0
Outputs								
Sales gas, MMscfd	184.342	61.073	123.270		—	1.373	13.166	210.944
Condensate, stock-tank bbl/day	9,233.290	3,060.146	6,173.144	123.600	—	12.062	491.048	9,860.00
Gas to Matrouh, MMscfd	8.009	2.671	5.338	0.502	—	0.069	0.785	9.365

Source: Khalda Petroleum Co.

Acknowledgments

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NELSON-FARRAR COST INDEXES

Refinery construction (1946 Basis)

(Explained on p.145 of the Dec. 30, 1985, issue)

	1962	1980	2003	2004	2005	June 2005	May 2006	June 2006
Pumps, compressors, etc.	222.5	777.3	1,540.2	1,581.5	1685.5	1,684.9	1,747.3	1,751.1
Electrical machinery	189.5	394.7	522.0	516.9	513.6	512.8	514.6	522.3
Internal-comb. engines	183.4	512.6	911.7	919.4	931.1	927.3	956.9	958.8
Instruments	214.8	587.3	1,076.8	1,087.6	1,108.0	1,107.2	1,148.5	1,156.9
Heat exchangers	183.6	618.7	732.7	863.8	1,072.3	1,079.2	1,179.4	1,179.4
Misc. equip. average	198.8	578.1	956.7	993.8	1,062.1	1,062.3	1,109.3	1,113.7
Materials component	205.9	629.2	933.8	1,112.7	1,179.8	1,143.2	1,262.8	1,289.1
Labor component	258.8	951.9	,228.1	2,314.2	2,411.6	2,393.7	2,478.6	2,479.3
Refinery (Inflation) Index	237.6	822.8	1,710.4	1,833.6	1,918.8	1,893.5	1,992.3	2,003.2

Refinery operating (1956 Basis)

(Explained on p.145 of the Dec. 30, 1985, issue)

	1962	1980	2003	2004	2005	June 2005	May 2006	June 2006
Fuel cost	100.9	810.5	934.8	971.9	1,360.2	1,260.9	1,670.2	1,583.8
Labor cost	93.9	200.5	200.8	191.8	201.9	187.3	200.6	191.5
Wages	123.9	439.9	971.8	984.0	1,007.4	1,000.1	1,017.5	990.4
Productivity	131.8	226.3	485.4	513.3	501.1	533.9	507.2	517.0
Invest., maint., etc.	121.7	324.8	643.0	686.7	716.0	706.5	737.9	741.9
Chemical costs	96.7	229.2	237.7	268.2	310.5	301.1	363.8	372.2
Operating indexes								
Refinery	103.7	312.7	464.7	486.7	542.1	522.6	584.0	575.3
*Process units**	103.6	457.5	612.5	638.1	787.2	744.8	903.0	871.5

**Add separate index(es) for chemicals, if any are used. See current Quarterly Costimating, first issue, months of January, April, July, and October.*

These indexes are published in the first issue of each month. They are compiled by Gary Farrar, Journal Contributing Editor.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the months of January, April, July, and October.

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Equipment costs rise moderately

Gary Farrar
Contributing Editor

Costs for the five equipment items that make up the Nelson-Farrar miscellaneous equipment cost index were mixed during 2004-05. The miscellaneous equipment index average rose to 1,073.5 from 959.8 in the 24-month period.

The greatest increase among the components making up the equipment average was that of heat exchangers, which increased to 1,079.2 in December 2005 from 732.7 in January 2004.

Engines increased only slightly during the period. Instruments gained 46.0 during the 2004-05 period examined.

Electrical machinery dropped to 509.6 in December 2005 from 516.4 in January 2004.

The pumps and compressors average increased to 1,721.8 in December 2005 from 1,557.3 in 2004. ✦

Miscellaneous equipment index

Year, and month	Code 1141 Pumps, compressors	Code 117 Electrical machinery	Code 1194 Engines	Instru-ments	Heat exchangers	Misc. equipment average
2004						
Jan.	1,557.3	516.4	919.7	1,073.0	732.7	959.8
Feb.	1,560.2	517.7	919.1	1,070.9	732.7	960.1
Mar.	1,560.2	516.8	919.1	1,074.0	732.7	960.6
Apr.	1,558.3	519.6	918.4	1,082.7	793.1	974.4
May	1,569.6	520.0	919.1	1,084.2	877.2	994.0
June	1,577.2	517.3	919.1	1,086.8	877.2	995.5
July	1,582.8	516.4	919.7	1,088.1	877.2	996.9
Aug.	1,588.5	516.4	918.4	1,089.3	877.2	998.0
Sept.	1,594.2	515.5	919.7	1,101.1	877.2	1,001.5
Oct.	1,599.9	516.4	918.4	1,094.7	995.9	1,025.1
Nov.	1,613.1	515.5	920.3	1,101.7	995.9	1,029.3
Dec.	1,616.9	514.6	921.6	1,105.3	995.9	1,030.9
Year	**1,581.5**	**516.9**	**919.4**	**1,087.7**	**863.7**	**993.8**
2005						
Jan.	1,630.1	515.5	929.8	1,094.9	995.9	1,033.2
Feb.	1,660.3	515.5	934.8	1,097.9	1,079.2	1,057.6
Mar.	1,671.7	515.0	926.6	1,098.8	1,079.2	1,058.3
Apr.	1,674.5	514.6	929.2	1,102.1	1,079.2	1,059.9
May	1,675.5	512.8	926.0	1,107.8	1,079.2	1,060.3
June	1,684.9	512.8	927.3	1,107.2	1,079.2	1,062.3
July	1,687.7	514.6	928.5	1,112.8	1,079.2	1,064.6
Aug.	1,696.2	514.1	931.0	1,111.7	1,079.2	1,066.5
Sept.	1,701.0	513.7	931.0	1,111.7	1,079.2	1,067.3
Oct.	1,706.6	514.1	935.5	1,113.6	1,079.2	1,069.8
Nov.	1,715.1	510.9	935.5	1,118.4	1,079.2	1,071.8
Dec.	1,721.8	509.6	938.0	1,119.0	1,079.2	1,073.5
Year	**1,685.5**	**513.6**	**931.1**	**1,108.0**	**1,072.3**	**1,062.1**

Itemized refining cost indexes

The cost indexes may be used to convert prices at any date to prices at other dates by ratios to the cost indexes of the same date. Item indexes are published each quarter (first week issue of January, April, July, and October). In addition the Nelson Construction and Operating Cost Indexes are published in the first issue of each month of Oil and Gas Journal.

Operating cost (based on 1956 = 100.0):	1954	1972	2003	2004	2005	May 2006	*References	Index for earlier year in Costimating and Questions on Technology issues
Power, industrial electrical	98.5	131.2	721.3	727.9	771.3	840.0	Code 0543	No. 13, May 19, 1958
Fuel, refinery price	85.5	152.0	900.9	944.5	1,288.9	1,589.5	OGJ	No. 4, Mar. 17, 1958
Gulf cargoes	85.0	130.4	1,402.8	1,250.7	1,635.4	2,274.7	OGJ	No. 4, Mar. 17, 1958
NY barges	82.6	169.6	1,102.9	1,130.7	1,539.6	1,893.0	OGJ	No. 4, Mar. 17, 1958
Chicago low sulfur	—	—	965.8	983.9	1,478.4	1,859.5	OGJ	July 7, 1975
Western US	84.3	168.1	1,272.6	1,427.7	1,941.5	2,580.3	OGJ	No. 4, Mar. 17, 1958
Central US	60.2	128.1	901.6	953.8	1,274.0	1,742.1	OGJ	No. 4, Mar. 17, 1958
Natural gas at wellhead	83.5	190.3	4,293.3	5,322.0	7,010.6	5,781.9	Code 531-10-1	No. 4, Mar. 17, 1958
Inorganic chemicals	96.0	123.1	488.3	504.9	562.9	692.8	Code 613	Oct. 5, 1964
Acid, hydrofluoric	95.5	144.4	414.9	414.9	414.9	414.9	Code 613-0222	Apr. 3, 1963
Acid, sulfuric	100.0	140.7	383.9	397.4	397.4	397.4	Code 613-0281	No. 94, May 15, 1961
Platinum	92.9	121.1	664.8	762.1	819.3	1,336.0	Code 1022-02-73	July 5, 1965, p. 117
Sodium carbonate	90.9	119.4	315.5	310.3	357.3	456.4	Code 613-01-03	No. 58, Oct. 12, 1959
Sodium hydroxide	95.5	136.2	529.6	529.6	529.6	625.3	Code 613-01-04	No. 94, May 15, 1961
Sodium phosphate	97.4	107.0	733.7	733.7	733.7	733.7	Code 613-0267	No. 58, Oct. 12, 1959
Organic chemicals	100.0	87.4	496.9	587.9	666.5	754.9	Code 614	Oct. 5, 1964
Furfural	94.5	137.5	717.1	848.1	961.9	1,089.2	Chemical Marketing Reporter	No. 58, Oct. 12, 1959
MEK, tank-car lots	82.6	87.5	402.1	408.3	625.0	625.0	Reporter	
Phenol	90.4	47.1	333.5	339.1	411.3	361.3	Code 614-0241	No. 58, Oct. 12, 1959

ITEMIZED REFINING COST INDEXES

Operating cost (based on 1956 = 100.0):	1954	1972	2003	2004	2005	May 2006	*References	Index for earlier year in Costimating and Questions on Technology issues
Operating labor cost (1956 = 100)								
Wages & benefits	88.7	210.0	971.8	984.0	1,007.0	1,017.5	Employ & Earn	No. 41, Feb. 16, 1969
Productivity	97.2	197.0	485.4	513.3	501.1	507.2	Employ & Earn	No. 41, Feb. 16, 1969
Construction labor cost (1946 = 100)								
Skilled const.	174.6	499.9	2,002.5	2,077.2	2,170.8	2,223.9	Eng. News Record	No. 55, Nov. 3, 1949
Common labor	192.1	630.6	2,646.9	2,747.1	2,863.5	2,951.6	Eng. News Record	No. 55, Nov. 3, 1949
Refinery cost	183.3	545.9	2,228.1	2,314.2	2,411.6	2,478.6	OGJ	May 15, 1967
Equipment or materials (1946 = 100):								
Bubble tray	161.4	324.4	1,168.2	1,329.6	1,409.4	1,458.6	Computed	July 8, 1962, p. 113
Building materials (nonmetallic)	143.6	212.4	799.4	825.9	886.4	967.6	Code 13	No. 61, Dec. 15, 1949
Brick—building	144.7	252.5	1,190.0	1,215.8	1,301.7	1,409.1	Code 1342	No. 20, Mar. 3, 1949
Brick—fireclay	193.1	322.8	1,308.2	1,358.6	1,441.1	1,544.9	Code 135	May 30, 1955
Castings, iron	188.1	274.9	1,138.0	1,192.5	1,290.0	1,344.3	Code 1015	Apr. 1, 1963
Clay products (structural, etc.)	159.1	342.0	829.3	843.9	893.8	950.1	Code 134	No. 20, Mar. 3, 1949
Concrete ingredients	141.1	218.4	879.7	908.3	985.5	1,084.9	Code 132	No. 22, March 17, 1949
Concrete products	138.5	199.6	727.6	761.9	841.3	921.0	Code 133	Oct. 2, 1967, p. 112
Electrical machinery	159.9	216.3	522.0	516.9	513.6	514.6	Code 117	May 2, 1955
Motors and generators	157.7	211.0	782.9	796.8	839.2	865.4	Code 1173	May 2, 1955
Switchgear	171.2	271.0	1,022.9	1,045.9	1,090.0	1,132.7	Code 1175	May 2, 1955
Transformers	161.9	149.3	471.2	486.0	537.1	582.2	Code 1174	No. 31, May 19, 1949
Engines (combustion)	150.5	233.3	911.7	919.4	931.1	956.9	Code 1194	No. 36, June 23, 1949
Exchangers (composite)	171.7	274.3	732.7	863.8	1,072.3	1,179.4	Manufacturer	Mar. 16, 1964
Copper base	190.7	266.7	714.2	816.2	992.1	1,081.8	Manufacturer	Mar. 16, 1964
Carbon steel	156.8	281.9	727.6	866.1	1,080.2	1,189.4	Manufacturer	Mar. 16, 1964
Stainless steel (304)	—	—	759.9	914.3	1,119.3	1,193.3	Manufacturer	July 1, 1991
Fractionating towers	151.0	278.5	968.5	1,065.1	1,157.2	1,192.3	Computed	June 8, 1963, p. 133
Hand tools	173.8	346.5	1,609.9	1,651.7	1,722.1	1,795.5	Code 1042	June 27, 1955
Instruments (composite)	154.6	328.4	1,076.8	1,087.6	1,108.0	1,148.5	Computed	No. 34, June 9, 1949
Insulation (composite)	198.5	272.4	2,208.7	2,230.4	2,228.6	2,240.2	Manufacturer	July 4, 1988, p. 193
Lumber (composite):	197.8	353.4	1,208.8	1,417.9	1,359.6	1,396.0	Code 81	No. 7, Dec. 2, 1948
Southern pine	181.2	303.9	831.4	1,040.7	998.6	1,193.5	Code 81102	No. 7, Dec. 2, 1948
Redwood, all heart	238.0	310.6	1,743.8	2,145.1	2,057.9	2,138.0	Code 811-0332	July 5, 1965, p. 117
Machinery								
General purpose	159.9	278.5	1,076.1	1,106.7	1,163.6	1,200.6	Code 114	Feb. 17, 1949
Construction	165.9	324.4	1,361.6	1,407.3	1,499.2	1,557.7	Code 112	Apr. 1, 1968, p. 184
Oil field	161.9	269.1	1,295.5	1,333.0	1,454.8	1,588.2	Code 1191	Oct. 10, 1955
Paints—prepared	159.0	231.8	883.0	907.4	975.3	1,044.2	Code 621	May 16, 1955
Pipe								
Gray iron pressure	195.0	346.9	1,980.1	2,301.2	2,580.2	2,697.9	Code 1015-0239	Jan. 3, 1983
Standard carbon	182.7	319.9	1,298.3	1,900.0	2,217.3	2,272.2	Code 1017-0611	Jan. 3, 1983
Pumps, compressors, etc.	166.5	337.5	1,540.2	1,581.5	1,685.5	1,747.3	Code 1141	No. 29, May 5, 1949
Steel-mill products	187.1	330.6	969.9	1,300.6	1,409.1	1,480.4	Code 1017	Jan. 3, 1983
Alloy bars	198.7	349.4	842.1	1,050.1	1,146.8	1,205.3	Code 1017-0831	Apr. 1, 1963
Cold-rolled sheets	187.0	365.5	1,095.1	1,278.4	1,462.5	1,487.1	Code 1017-0711	Jan. 3, 1983
Alloy sheets	177.0	225.9	547.1	665.0	760.3	773.5	Code 1017-0733	Jan. 3, 1983
Stainless strip	169.0	221.2	566.0	710.0	811.6	825.5	Code 1017-0755	Jan. 3, 1983
Structural carbon, plates	193.4	386.7	1,025.1	1,493.7	1,654.5	1,728.0	Code 1017-0400	Jan. 3, 1983
Welded carbon tubing	180.0	265.5	1,315.5	1,925.0	2,246.8	2,302.1	Code 1017-0622	Jan. 3, 1983
Tanks and pressure vessels	147.3	246.4	789.7	868.7	974.4	1,003.2	Code 1072	No. 5, Nov. 18, 1949
Tube stills	123.0	125.3	410.0	503.5	540.5	566.3	Computed	Oct. 1, 1962
Valves and fittings	197.0	350.9	1,608.7	1,660.6	1,738.2	1,813.0	Code 1149	No. 46, Sept. 1, 1940
Nelson-Farrar Refinery (Inflation Index)								
(1946)	179.8	438.5	1,710.4	1,833.6	1,918.8	1,992.3	OGJ	May 15, 1969
Nelson-Farrar Refinery Operation								
(1956)	88.7	118.5	464.7	486.7	542.1	584.0	OGJ	No. 2, Mar. 3, 1958
Nelson-Farrar Refinery Process								
(1956)	88.4	147.0	612.5	638.1	787.2	903.0	OGJ	No. 2, Mar. 3, 1958

*Code refers to the index number of the Bureau of Statistics, US Department of Labor, "Wholesale Prices" Itemized Cost Indexes, Oil & Gas Journal.

DIRECT ASSESSMENT—1

Software module hones system-wide practices

Menno van Os
N.V. Nederlandse Gasunie

Gasunie has utilized external corrosion direct assessment (ECDA) as proposed by the National Association of Corrosion Engineers (NACE) as a valuable method of assessing the corrosion threat in unpiggable pipelines.

Structural-reliability analysis (SRA) combined with Bayesian statistics make it possible to quantify the results of an ECDA process. This combined method allows automatic adjustment of the expected number of both coating and corrosion defects based on the results of two aboveground surveys (one for the detection of each).

The method makes it possible to use the results of excavations to adjust the following variables:

- The probabilities of detection and of false indication of each survey technique.
- The time of initiation of corrosion defects and the defect density.
- The corrosion rate and the defect depth.

Adjusting these variables allows the probability of failure of the pipeline being inspected to be calculated and updated on a per-kilometer basis. This updating process can in turn be performed after each (x) number of excavations, until the system reaches a sufficiently low probability of failure, allowing the integrity manager to minimize the number of excavations required.

Gasunie has been implementing this approach as part of its pipeline integrity management system, PIMSlider, during 2006. Gasunie intends the approach to be an integral part of the system, providing access to all relevant data of both the pipeline under investigation and direct assessments performed on other pipelines.

Based on presentation to the World Gas Conference, Amsterdam, June 5-9, 2006

History

Gasunie owns roughly 12,000 km of high-pressure pipeline in the Netherlands, most of which were built between 1960 and 1980. Aging of the grid has led increasingly to spots with coating degeneration and reduced wall thickness caused by both corrosion and mechanical damage. Gasunie also detected microbiologically influenced corrosion (MIC) on the grid in 1999.

These circumstances led Gasunie's asset-management department to reexamine its pipeline management policy in order to maintain a high standard on risk and integrity control. Gasunie concluded that a change from verification of preventive measures to verification of the actual condition of the pipelines was required.

This conclusion resulted in the introduction of two strategies:

- Integrity management: to comply with prescribed governmental requirements and restrictions on the integrity of the assets; to prioritize and perform preventive activities; and to monitor the actual condition of pipelines.
- Risk management: to realize and preserve the environmental integrity of the pipeline within acceptable (or agreed) levels and to prioritize and perform mitigating activities.

These strategies led to the intensification of Gasunie's in-line inspection (ILI) program to 5-10 ILI runs/year, resulting in a significant increase in the amount of inspection data needing analysis.

Gasunie implemented a new IT solution (PIMSlider) to allow efficient and reliable data processing and support all pipeline integrity-management processes.

Since only 50% of Gasunie's pipelines are conventionally piggable, it decided in 2005 to develop a computerized direct-assessment module for PIMSlider, enabling integrity analyses of unpiggable pipelines and meeting the requirements of the ECDA process

described in NACE RP0502-2002.[1]

This first of two articles focuses on the direct assessment module of PIMSlider, currently being developed by Gasunie in cooperation with Andrew Francis & Associates Ltd. (AFAA), Derbyshire, UK, ATP Ltd., Hampshire, UK, and ATP Neftegazsystema, Gomel, Belarus. The concluding article will detail the ECDA results for a section of Gasunie line.

PIMSlider

The PIMSlider system consists of a number of modules, the center of which is Slider.[2] The modules cover the spectrum of data management (pipeline, environmental, and incident data), CP system monitoring data, analyses of ILI data, defect assessments, and quantitative risk calculations with consideration of the economics involved.

The Slider module stores all pipeline-related data concerning position, equipment, crossings, operational data, ILI data, maps, photographs, population density along its route, etc. It mainly provides information retrieval. The operator can track relationships between various data points (Fig. 1) and schedule actions accordingly (surveys, repair, maintenance, etc).

The CP Expert module allows the operator to analyze the effectiveness and the efficiency of an existing CP system. A modeling function supports the CP engineer in the design of the CP system in case of construction or modification of a pipeline. CP Expert uses data from Slider. It also allows calculation of the optimum operation mode for CP stations, ensuring reliable and effective protection of the pipeline.

The Gasunie Pipeline Incidents Database (GDLI) contains all pipeline incidents that have occurred on the Gasunie grid. The GDLI module analyzes these incidents.

Inpipe enables the analysis of any kind of pipeline defect or other feature drawn from data provided by ILI tools. This involves linking the features to map coordinates and accurate positioning of the in-line data along a 3D model of the pipeline. The software calculates the remaining strength of the pipeline using the methods of ASME B31G and RSTRENG.

The Rehab Expert module allows the operator to assess the significance of defects in the pipeline and to define the most appropriate repair program. Either defect-geometry data, as reported by the ILI contractor, or raw data from inspection tools (such as individual sensor signals) can provide the basis for assessing defects. Using more than one ILI program allows comparison of the same defect at different stages of its lifetime, enabling the operator to optimize the economics of inspection and repair.

The PSL module provides the core of the system with respect to risk management of gas transmission pipelines. It is a hazard and risk-assessment package and enables automatic quantitative risk calculations to be made at any moment for any pipeline in the Slider database. It also allows the engineer to calculate the effect of risk mitigating measures on existing pipeline.

The approaches and assumptions used in PIPESAFE, a risk-assessment model for gas transmission pipelines developed by a group of international gas transmission companies, provide the basis for PSL.

The Risk Expert module allows the operator to carry out a relative risk assessment of the pipeline, prioritizing maintenance and inspection. This data-based method uses a model that identifies and quantifies the major threats and consequences of pipeline objects and the pipeline environment. Operational experience, expert opinion, and industry experience quantify the likelihood of all threats, with calculations performed for all pipeline sections (parts of the pipeline with unchanged conditions) making it possible to identify local high-risk areas.

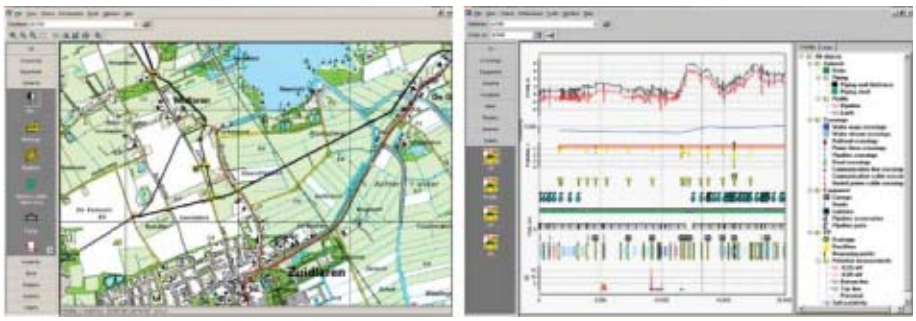
Direct-assessment module

The DA module of PIMSlider allows computerized storage, retrieval, and processing of all appropriate pipeline data stored in the PIMSlider database, guaranteeing highly accurate, reproducible, and time-saving integrity analyses of the entire Gasunie grid.

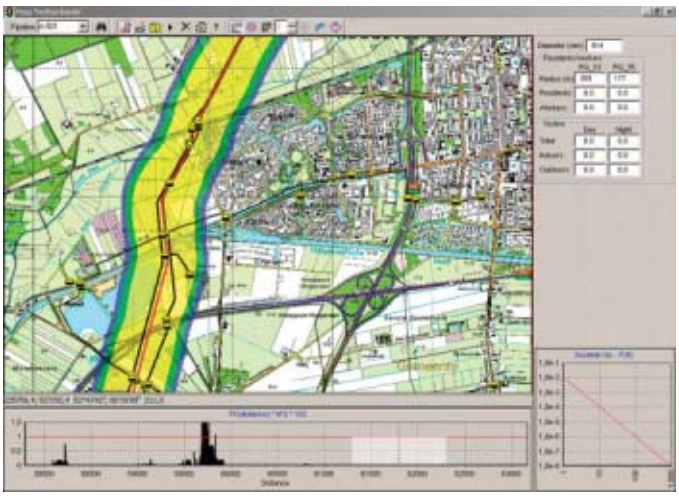
The module is based on the NACE Recommended Practice for ECDA[1] in combination with SRA. The ECDA process integrates information on the pipeline's physical characteristics including operating history (preassessment) with data from multiple field examinations (indirect inspections) and pipe surface evaluations (direct examinations).

SRA in combination with Bayesian statistics allows quantifying the effect of inspections and excavations on the integrity of the pipeline, supporting the integrity manager in the definition of a required inspection program.[3-7] Increasing reliability through SRA and Bayesian statistics can result in substantial inspection cost savings.

The DA module models the external



The Slider module forms the core of Gasunie's PIMSlider integrity-management software system. Mainly used for information retrieval, Slider allows the operator to track relationships between various segments of the system and schedule actions accordingly. The screens shown depict the geographical position of a particular pipeline section (left) and related operational data (right; Fig. 1).



PIMSlider's PSL module provides continuous real-time hazard and risk-assessment, enabling automatic quantitative risk calculations for any pipeline in the Slider database. PSL color-codes impact zones for various events along whatever section of Gasunie pipeline is being observed (Fig. 2).

corrosion failure mode in detail. A constant represents other failure modes.

Ongoing research at Gasunie Engineering & Technology and contributions by AAFA have led to improvements on the model originally developed by Gasunie in 2004.[8,9] The current module consists of the following parts:

- Preassessment.
- Indirect inspections.
- Direct examination and postassessment.

Preassessment includes data collection and visualization, identification of so-called ECDA regions, and calculation of the baseline probability of failure of the pipeline. Indirect inspection identifies and defines the severity of coating faults, other anomalies, and areas at which corrosion activity might be occurring.

Direct examinations determine which indications from the indirect inspections are most severe, collect data to assess corrosion activity, and repair critical defects. Finally, postassessment defines reassessment intervals and assesses the overall effectiveness of the ECDA. This step integrates all ECDA regions as well as the failure frequencies of other failure modes.

Failure modes

Integrity management requires that all the potential threats to a pipeline (failure modes) be considered. The direct-assessment module uses the American Society of Mechanical Engineer's guidelines. The DA module evaluates the integrity of a pipeline by assessing its failure rate, expressed as the probability of failure/kilometer/year.

Direct assessment of external corrosion (ECDA) is modeled in detail. The DA module, however, allows models for other relevant failure modes to be added as they become necessary. For now, the module models contributions of other failure modes to the overall integrity of the pipeline as a constant.

Managing pipeline integrity holds identification of potential existing threats as its first step, with all threats to the integrity of the pipeline needing consideration. The Pipeline Research Committee International (PRCI) has analyzed a large number of gas pipeline and established 22 different causes. The ASME has grouped these causes into nine different failure mode categories (Table 1).[10]

The PIMSlider DA module uses a division in failure modes to the level of Table 1's subcategories.

Gasunie has recorded all incidents on its grid in the Gasunie Database for Pipeline Incidents. The incidents include leaks and ruptures, as well as coating damage and damage caused by corrosion.

The main failure modes are:

- External interference (third party) 71%.
- External corrosion 6%.
- Material and welding defects 4% (mostly welding defects).
- Ground movement (sinking) 2%.

The PIMSlider PSL module addresses external interference and its consequences.

The PIMSlider DA module models external corrosion.

The effects of aging on the pipeline grid and the growth of corrosion defects over time only heighten the importance of modeling external corrosion as a failure mode.

Studies indicate that material and welding defects and internal corrosion are more important failure modes for other pipeline operators than they are for Gasunie.[11-13]

Gasunie believes that external corrosion should not contribute significantly to total incident frequency but has yet to set a criterion for the maximum failure rate from this cause.

A NACE standard exists for ECDA and a complete model has been established, based on the work of Francis et al. The

Failure mode categories

Table 1

Main category	Subcategory	Failure mode
Time-dependent	External corrosion	
	Internal corrosion	
	Stress corrosion cracking (SCC)	
Time-independent, internal cause	Manufacturing defects	Defective pipe seam Defective pipe
	Welding, fabrication defects	Defective girth weld Defective fabrication weld
	Equipment defects	
Time-independent, external cause (including operation)	Third-party damage	Immediate failure Previously damaged pipe
	Incorrect operations	
	Weather-related, outside force	Cold weather Lightning Heavy rains, floods Ground movements

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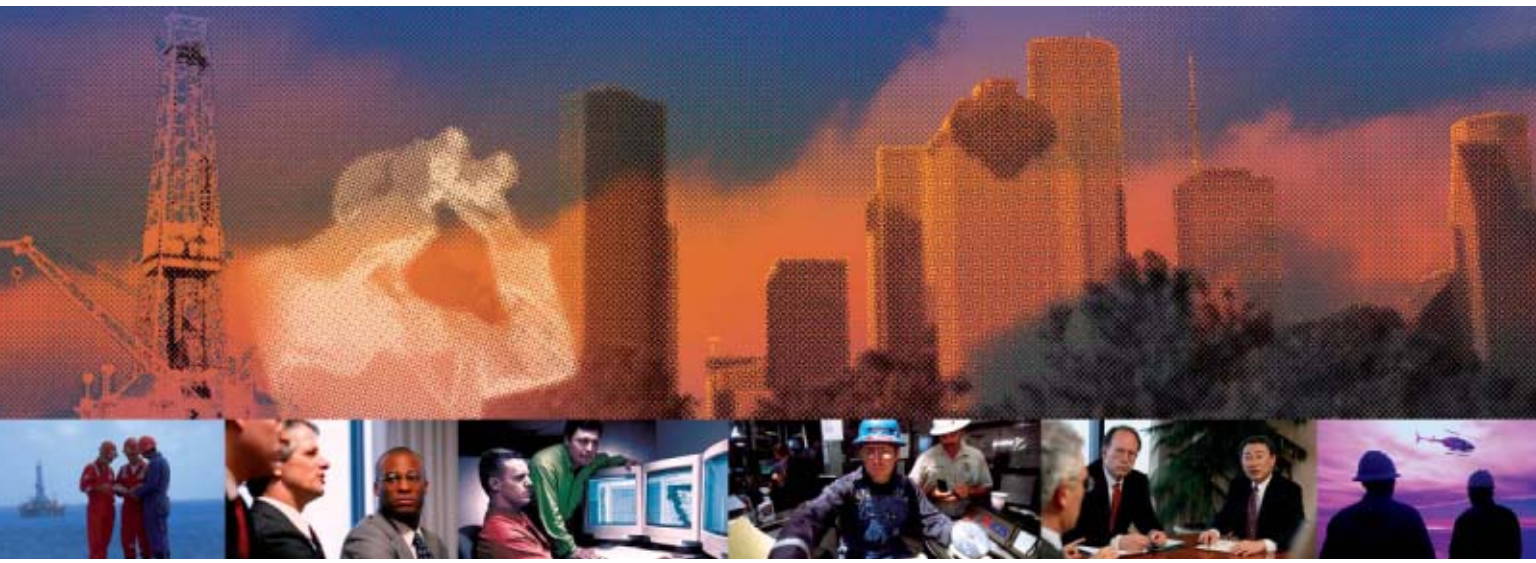

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DA module of PIMSlider implements this model.

NACE has developed standards for other corrosion direct assessments, such as internal corrosion (ICDA) and stress-corrosion cracking (SCCDA), but no comprehensive models are available yet.

The outlines of these standards are largely comparable to that of external corrosion, but they will not be included in PIMSlider until corresponding probabilistic models have been developed. Gasunie does not consider either of these failure modes to be a significant threat to its grid at present.

Various causes lead to external corrosion. When a coating defect is present (however small) and the cathodic protection applied is insufficient (or even too high), stray currents, AC interference, bacteria (MIC), tensile stress (SCC), and shielding of CP or overprotection may all lead to corrosion. ECDA does not cover MIC, SCC, or shielding of CP and overprotection. Since MIC is often associated with disbonded coating (i.e. shielding of CP), ECDA should not be applied in areas where MIC is known to occur.

ECDA covers general corrosion, AC corrosion, and stray current corrosion.

ECDA techniques can be used to find MIC corrosion, since experience with MIC at Gasunie indicates that it often occurs in combination with (or leads to) degenerated coating. This implies that an initially shielded defect suffering from MIC may eventually become accessible to CP currents due to degeneration of the coating, thereby enabling aboveground detection of the defect.

Preassessment

There are three main purposes to the preassessment step:

- Data collection and visualization.
- Identification of ECDA regions.
- Establishing the prior condition of the pipeline.

The first part of the preassessment, as set out by NACE, calls for a sufficient amount of data collection, integration, and analysis. Initial ECDA applications shall consider all parameters that affect the selection of the indirect inspection tools and the definition of the ECDA regions. Table 2 lists the elements of the Gasunie grid identified as essential in order to assess the prior condition of the pipeline.

In the second part of the preassessment, the gathered information defines a number of ECDA regions. An ECDA region consists of one (or more) section(s) of the pipeline with similar physical characteristics, corrosion histories, expected future corrosion conditions, and the ability to be examined by the same indirect inspection tools.

After the user has defined the parameters to be considered for identification of the ECDA regions, the DA module calculates the regions. These ECDA regions can then assist the user in interpreting results, deciding which indirect inspection tools can be used, and where direct examinations should be performed.

The third part of the preassessment quantifies the previous condition of the pipeline under investigation by assessing the failure probability of each ECDA region. Key parameters for which estimates must be made in calculating the probability of failure include:

- Time of initiation of corrosion defects. During the time between construction and going into service, the conditions for corrosion are established and the first instances of early corrosion growth take place.
- Defect density (for both coating and corrosion defects). This is a value that consists primarily of a starting value representing damages originating in the transportation and construction phases of the pipe and pipeline. Secondly, it represents the rate of introduction of new defects, starting from the initiation of service.
- Defect depth. A certain initial distribution for the defect depth is assumed at the time service is initiated, after which it gradually increases, depending on the corrosion rate.
- Corrosion rate. This is the rate at which the defect depth grows and is a major cause of uncertainty and likely to vary considerably between pipelines.

Information collected during the first part of preassessment provides the basis for these estimations. Combining data regarding factors such as the age of the pipeline, coating type, level of CP, and soil conditions determines the prior distribution of the densities of coating and corrosion defects, with the prior distributions defining the geometry of corrosion defects.

If relevant information is not available for a specific pipeline, the user can fall back on the complete database of all pipelines for the required analysis. This functionality (automatic retrieval of data from pipelines with similar specifications or environmental conditions) results in a huge increase of accessible data (now and especially in future) and makes it possible to reduce the cost of inspections

RELEVANT ECDA DATA ELEMENTS, GASUNIE GRID Table 2

Category	Elements
Pipe-related	Material, grade
	OD
	WT
Construction-related	Year installed
	Year of route change, modification
	Location of valves, clamps, supports, taps, couplings, insulating joints, etc.
	Casing locations, material
	Depth of cover
	Underwater sections, river crossings
	Location; river weights, anchors
Soils, environmental	Soil type (e.g., presence of peat, anaerobic soils)
	Electrical influence (e.g., proximity to DC railways, AC power lines)
	Pollution
	Drainage
	Land use (e.g., paved roads)
Corrosion control	Rectifier locations
	Test point locations
	Coating type
	CP survey data, history
Operational data	Pipe inspection reports, excavation reports
	Repair history (e.g., sleeves, locations)
	Previous aboveground survey data
	Inline inspection data

substantially by applying statistics.

In practice, parameters concerning the geometry of the pipeline (e.g., WT) or material properties (e.g., flow stress) are also associated with uncertainties, especially in the case of older pipelines. The DA module treats these quantities as probability density functions as well, rather than using constant values.

The model can also calculate the probability that a single defect will fail, depending on the age of the pipeline and the uncertainties described earlier. Guidelines from the Linepipe Corrosion Group-sponsored JIP, developed through a combination of analysis and full-scale testing, predict the failure pressure of part-wall corrosion defects.[14] Combining the probability of failure for a single defect with the previously determined defect density allows calculation of the probability of failure for each ECDA region.

Indirect inspection

Indirect inspection seeks to identify and define the severity of coating faults, other anomalies, and areas at which corrosion activity may have occurred or may be occurring. NACE requires the use of at least two aboveground inspections over the entire length of each ECDA region. Gasunie indirect inspections for ECDA purposes usually consist of:

- Direct Current Voltage Gradient (DCVG) survey to detect and pinpoint coating defects along the pipeline.
- Close Interval Potential Survey (CIPS) to measure both the pipeline's on-off potentials and the on-off potential gradients to remote earth. These measurements determine whether a possible coating defect is sufficiently protected by the CP system.
- Wenner measurements to measure the soil resistivity at regular intervals along the route.
- dGPS measurements to measure the position of coating-defect indications, soil resistivity, and characteristic features along the pipeline.

Fig. 3 shows a typical survey team. In this approach, CIPS does not detect coating defects but instead assesses corrosion activity at possible anomaly locations detected by DCVG. Francis et al., however, produced complete derivations for the use of 1 or 2 coating surveys or 1 coating and 1 corrosion survey.

The lack of a 100% reliable inspection technique requires that the performance of the inspection tools used is also taken into account, including other variables such as type of coating, soil conditions, and depth of cover.

Two variables characterize tool performance:

- Probability of Detection (PoD): the probability that a defect present is detected by the survey technique.
- Probability of False Indication (PoFI): the probability that the survey technique gives an indication where no actual defect is present.

Indirect inspection consists of:

- Data storage. The data from the aboveground surveys are stored in a database for processing and future reference.
- Data processing, interpretation, and visualization. If required, the data from the surveys can be corrected for factors such as the depth of cover and currents through the pipeline.

The DA module also calculates the IR-free potential (the potential of the steel at the exact point where the surface of the steel meets the surrounding environment, not distorted by the soil resistance between reference electrode and pipeline) and its uncertainty. The DA module presents the required data in a clear and comprehensive manner by plotting (combinations of) graphs on the screen, simplifying interpretation of data by the operator.

- Generation of a priority list of direct examination (excavation) sites. This list will be generated based on parameters chosen by the operator such as coating defect size, expected corrosion, and soil resistivity.
- Establishing the condition of the pipeline after indirect inspection. Based on findings from the aboveground surveys, the distribution of coating and corrosion defects are updated with Bayesian statistics. The performance characteristics of the applied survey techniques play an important role in these calculations.

The prior distributions of the PoD and the PoFI of a survey technique can be constructed from previous experi-

Gasunie deploys indirect inspection teams to conduct DC voltage gradient and close-interval potential surveys, as well as acquire GPS measurements for any defect indications. Indirect inspection seeks to identify and define the severity of coating faults and other anomalies where corrosion activity may be occurring. NACE requires at least two such inspections over the entire length on an ECDA region (Fig. 3).

ence with the technique or from manufacturer recommendations.

Acknowledgments

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New line of ultrasonic flowmeters

Newly released Innova-Sonic ultrasonic flowmeters are universal transit-time instruments incorporating advances in digital signal processing.

The portable version features Bluetooth wireless PDA interface for a flexible and convenient flow measurement tool. Innova-Sonic is also available with fixed display readout in a choice of clamp-on or insertion transducers.

While mainly designed for clean liquid applications, units tolerate liquids with small volumes of air bubbles or suspended solids. All flowmeters offer low power consumption, high reliability, and applicability at an economical cost, the firm says.

An easy to read display and clear, user friendly menu selections help make using the instrument simple and convenient. The instrument can be configured via keypad without any additional programming devices and is packaged in a die cast NEMA 4X (IP65) housing.

Meters feature a self-contained 4-20 ma current loop signal output for instantaneous flow as well as two independent temperature inputs for thermal energy monitoring.

The instrument also features a seven digit alphanumeric display, parallel operation of positive, negative, and net flow totalizers (with user-selectable scale factors), and configurable pulse and frequency outputs (transmitted via relay and open collector) for totalized flow.

Source: **Sierra Instruments Inc.**, 5 Harris Court, Bldg. L, Monterey, CA 93940.

New explosionproof computing display

The new Triton D1 explosionproof computing display carries the Certified Class l Zone l/ATEX Zone l and electrical protection class EMC/EN61326 for maximum protection in hazardous-classified applications such as offshore and land-based well logging, rig floor instrumentation, and mud logging.

Also it also carries the Class I, Zone I, Ex d IIB T4 and Class I, Zone l, AEx d IIB T4 certifications in the US and Canada and the ATEX II 2 G, EEx d IIB T4 certificate in Europe.

The Triton D1 features modular construction with a flameproof all-machined aluminum enclosure. The modular design has easily serviceable subassembly units that shorten repair time, the company points out.

Its design incorporates a 15-in. full sunlight viewable display with EnhancedInfrared touch screen technology.

Source: **Kontron America**, 14118 Stowe Drive, Poway, CA 92064-7147.

Statistics

Editor's note: API data were not available at presstime.

OGJ GASOLINE PRICES

	Price ex tax 9-20-06	Pump price* 9-20-06	Pump price 9-21-05
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	199.8	243.3	268.9
Baltimore	209.6	251.5	273.5
Boston	210.6	252.5	306.3
Buffalo	196.3	264.2	296.7
Miami	209.8	260.1	288.1
Newark	220.5	253.4	299.4
New York	200.5	268.4	302.7
Norfolk	192.5	230.5	284.0
Philadelphia	209.1	259.8	319.7
Pittsburgh	202.7	253.4	274.3
Wash., DC	226.1	264.5	302.2
PAD I avg.	207.0	254.7	292.3
Chicago	218.4	273.5	303.3
Cleveland	174.4	220.8	277.9
Des Moines	170.0	210.1	252.3
Detroit	179.0	231.9	264.7
Indianapolis	172.8	221.8	271.6
Kansas City	182.2	218.2	259.7
Louisville	178.2	215.1	268.2
Memphis	193.8	233.6	276.7
Milwaukee	200.5	251.8	285.2
Minn.-St. Paul	187.8	228.2	259.1
Oklahoma City	180.6	216.0	258.8
Omaha	179.0	224.4	277.0
St. Louis	191.0	227.0	276.5
Tulsa	180.7	216.1	258.5
Wichita	177.5	220.9	268.2
PAD II avg.	184.4	227.3	270.5
Albuquerque	207.2	243.6	273.4
Birmingham	181.9	220.6	275.9
Dallas-Fort Worth	177.8	216.2	271.9
Houston	181.4	219.8	275.9
Little Rock	183.3	223.5	267.1
New Orleans	207.1	245.5	NA
San Antonio	199.0	237.4	258.3
PAD III avg.	191.1	229.5	270.4
Cheyenne	225.8	258.2	284.9
Denver	228.2	268.6	297.9
Salt Lake City	233.8	276.7	286.1
PAD IV avg.	229.3	267.9	289.6
Los Angeles	209.6	270.2	303.9
Phoenix	203.9	241.3	303.1
Portland	226.0	269.3	281.2
San Diego	213.4	274.0	313.0
San Francisco	225.2	285.8	306.3
Seattle	229.3	278.7	292.3
PAD V avg.	217.9	269.9	300.0
Week's avg.	**199.4**	**243.8**	**275.3**
Aug. avg.	**252.4**	**296.7**	**250.2**
July avg.	**250.8**	**295.2**	**223.0**
2006 to date	**222.9**	**266.4**	—
2005 to date	**176.2**	**218.3**	—

*Includes state and federal motor fuel taxes and state sales tax. Local governments may impose additional taxes.
Source: Oil & Gas Journal.
Data available in Oil & Gas Journal Energy Database.

REFINED PRODUCT PRICES

	9-15-06 ¢/gal		9-15-06 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	162.25	New York Harbor	165.10
Gulf Coast	157.38	Gulf Coast	163.10
Los Angeles	169.75	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	151.55	ARA	172.65
Singapore	157.74	Singapore	175.69
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	157.63	New York Harbor	95.43
Gulf Coast	160.00	Gulf Coast	101.00
Los Angeles	176.75	Los Angeles	120.61
		ARA	106.10
		Singapore	105.59

Source: DOE Weekly Petroleum Status Report.
Data available in Oil & Gas Journal Energy Database.

BAKER HUGHES RIG COUNT

	9-22-06	9-23-05
Alabama	4	4
Alaska	6	8
Arkansas	26	12
California	33	29
Land	29	24
Offshore	4	5
Colorado	96	79
Florida	0	2
Illinois	0	0
Indiana	1	0
Kansas	7	7
Kentucky	9	7
Louisiana	198	188
N. Land	58	53
S. Inland waters	20	20
S. Land	44	36
Offshore	76	79
Maryland	1	0
Michigan	2	3
Mississippi	14	10
Montana	19	23
Nebraska	0	0
New Mexico	94	90
New York	7	5
North Dakota	37	29
Ohio	9	9
Oklahoma	196	152
Pennsylvania	14	14
South Dakota	3	4
Texas	788	633
Offshore	9	9
Inland waters	3	1
Dist. 1	24	12
Dist. 2	28	38
Dist. 3	58	97
Dist. 4	94	58
Dist. 5	139	80
Dist. 6	121	99
Dist. 7B	44	11
Dist. 7C	39	41
Dist. 8	91	77
Dist. 8A	24	22
Dist. 9	37	25
Dist. 10	77	63
Utah	45	26
West Virginia	26	25
Wyoming	112	86
Other-HI-1, ID-1, NV-2, TN-1, VA-1,WA-1	7	6
Total US	**1,754**	**1,451**
Total Canada	**380**	**426**
Grand total	**2,134**	**1,877**
Oil rigs	310	205
Gas rigs	1,422	1,239
Total offshore	95	97
Total cum. avg. YTD	**1,622**	**1,348**

Rotary rigs from spudding in to total depth.
Definitions, see OGJ Sept. 18, 2006, p. 46.

Source: Baker Hughes Inc.
Data available in Oil & Gas Journal Energy Database.

SMITH RIG COUNT

Proposed depth, ft	9-22-06 Rig count	9-22-06 Percent footage*	9-23-05 Rig count	9-23-05 Percent footage*
0-2,500	46	—	27	—
2,501-5,000	75	36.0	62	38.7
5,001-7,500	250	23.5	149	18.7
7,501-10,000	399	5.7	330	3.9
10,001-12,500	388	2.0	326	1.5
12,501-15,000	294	0.6	293	—
15,001-17,500	106	—	117	—
17,501-20,000	70	—	52	—
20,001-over	34	—	19	—
Total	**1,662**	**7.1**	**1,375**	**5.0**
INLAND	39		42	
LAND	1,556		1,266	
OFFSHORE	67		67	

*Rigs employed under footage contracts.
Definitions, see OGJ Sept. 18, 2006, p. 42.

Source: Smith International Inc.
Data available in Oil & Gas Journal Energy Database.

OGJ PRODUCTION REPORT

	[1]9-22-06	[2]9-23-05
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	18	21
Alaska	749	820
California	675	695
Colorado	59	50
Florida	7	6
Illinois	29	31
Kansas	90	92
Louisiana	1,331	325
Michigan	14	17
Mississippi	49	40
Montana	91	95
New Mexico	159	158
North Dakota	103	99
Oklahoma	170	169
Texas	1,344	1,183
Utah	44	45
Wyoming	141	142
All others	69	76
Total	**5,142**	**4,064**

[1]OGJ estimate. [2]Revised.

Source: Oil & Gas Journal.
Data available in Oil & Gas Journal Energy Database.

US CRUDE PRICES

$/bbl*	9-22-05
Alaska-North Slope 27°	66.71
South Louisiana Sweet	56.25
California-Kern River 13°	48.90
Lost Hills 30°	55.75
Wyoming Sweet	60.80
East Texas Sweet	58.65
West Texas Sour 34°	48.50
West Texas Intermediate	57.25
Oklahoma Sweet	57.25
Texas Upper Gulf Coast	54.00
Michigan Sour	50.25
Kansas Common	56.25
North Dakota Sweet	49.75

*Current major refiner's posted prices except North Slope lags 2 months. 40° gravity crude unless differing gravity is shown.

Source: Oil & Gas Journal.
Data available in Oil & Gas Journal Energy Database.

WORLD CRUDE PRICES

$/bbl[1]	9-15-06
United Kingdom-Brent 38°	62.97
Russia-Urals 32°	59.46
Saudi Light 34°	58.45
Dubai Fateh 32°	60.98
Algeria Saharan 44°	63.96
Nigeria-Bonny Light 37°	64.55
Indonesia-Minas 34°	64.55
Venezuela-Tia Juana Light 31°	57.75
Mexico-Isthmus 33°	57.64
OPEC basket	61.13
Total OPEC[2]	59.77
Total non-OPEC[2]	58.29
Total world[2]	58.89
US imports[3]	57.28

[1]Estimated contract prices. [2]Average price (FOB) weighted by estimated export volume. [3]Average price (FOB) weighted by estimated import volume.

Source: DOE Weekly Petroleum Status Report.
Data available in Oil & Gas Journal Energy Database.

US NATURAL GAS STORAGE[1]

	9-15-06	9-8-06	Change
	Bcf		
Producing region	915	886	29
Consuming region east	1,835	1,781	54
Consuming region west	427	417	10
Total US	**3,177**	**3,084**	**93**
	June 06	**June 05**	**Change, %**
Total US[2]	**2,617**	**2,197**	**19.1**

[1]Working gas. [2]At end of period.
Source: Energy Information Administration
Data available in Oil & Gas Journal Energy Database

PACE REFINING MARGINS

	July 2006	Aug. 2006	Sept. 2006	Sept. 2005	Change 2006 vs. 2005	Change, % 2006 vs. 2005
	$/bbl					
US Gulf Coast						
West Texas Sour	18.27	14.85	7.83	30.1	–22.30	–74.0
Composite US Gulf Refinery	20.40	16.11	7.47	26.2	–18.77	–71.5
Arabian Light	18.94	15.10	7.10	29.2	–22.06	–75.6
Bonny Light	13.31	8.62	1.64	24.5	–22.90	–93.3
US PADD II						
Chicago (WTI)	21.89	18.75	6.76	24.4	–17.59	–72.2
US East Coast						
NY Harbor (Arab Med)	10.38	9.43	3.23	17.9	–14.45	–81.7
East Coast Comp-RFG	14.55	12.12	4.81	22.0	–17.22	–78.2
US West Coast						
Los Angeles (ANS)	18.43	15.64	9.45	23.6	–14.15	–59.9
NW Europe						
Rotterdam (Brent)	2.41	2.03	1.61	6.6	5.00	–75.6
Mediterranean						
Italy (Urals)	8.89	9.78	6.82	12.3	–5.44	–44.4
Far East						
Singapore (Dubai)	1.15	0.04	–0.95	7.8	–8.71	–112.2

. Source: Jacobs Consultancy Inc.
Data available in Oil & Gas Journal Energy Database.

US NATURAL GAS BALANCE DEMAND/SUPPLY SCOREBOARD

	June 2006	May 2006	June 2005	June 2006-2005 change	Total YTD 2006	Total YTD 2005	YTD 2006-2005 change
	bcf						
DEMAND							
Consumption	1,503	1,548	1,525	–22	11,121	11,729	–608
Addition to storage	373	420	390	–17	1,419	1,336	83
Exports	52	60	55	–3	346	446	–100
Canada	14	22	18	–4	155	246	–91
Mexico	32	32	33	–1	158	170	–12
LNG	6	6	4	2	33	30	3
Total demand	**1,928**	**2,028**	**1,970**	**–42**	**12,886**	**13,511**	**–625**
SUPPLY							
Production (dry gas)	1,509	1,609	1,545	–36	9,209	9,326	–117
Supplemental gas	5	4	6	–1	34	34	0
Storage withdrawal	62	52	67	–5	1,435	1,840	–405
Imports	327	345	320	7	2,038	2,113	–75
Canada	265	278	264	1	1,736	1,798	–62
Mexico	0	0	0	0	3	1	2
LNG	62	67	56	6	299	314	–15
Total supply	**1,903**	**2,010**	**1,938**	**–35**	**12,716**	**13,313**	**–597**

NATURAL GAS IN UNDERGROUND STORAGE

	June 2006	May 2006	Apr. 2006	June 2005	Change
	bcf				
Base gas	4,216	4,202	4,198	4,201	15
Working gas	2,617	2,310	1,945	2,197	420
Total gas	**6,833**	**6,512**	**6,143**	**6,398**	**435**

Source: DOE Monthly Energy Review. **NOTE: No new data at press time.**
Data available in Oil & Gas Journal Energy Database.

WORLDWIDE NGL PRODUCTION

	June 2006	May 2006	6 month average – Production – 2006	2005	Change vs. previous year – Volume	Change vs. previous year – %
	1,000 b/d					
Brazil	85	80	84	72	12	16.5
Canada	600	699	684	671	13	1.9
Mexico	436	441	437	438	—	—
United States	1,753	1,753	1,714	1,830	–116	–6.4
Venezuela	200	200	200	200	—	—
Other Western Hemisphere	175	176	170	153	18	11.6
Western Hemisphere	**3,248**	**3,350**	**3,289**	**3,363**	**–74**	**–2.2**
Norway	237	273	282	268	14	5.1
United Kingdom	145	146	159	183	–24	–13.0
Other Western Europe	19	20	20	23	–3	–14.8
Western Europe	**401**	**439**	**461**	**475**	**–14**	**–2.9**
Russia	410	410	388	488	–100	–20.5
Other FSU	160	160	160	160	—	—
Other Eastern Europe	16	15	18	18	–1	–3.5
Eastern Europe	**586**	**585**	**566**	**667**	**–101**	**–15.1**
Algeria	295	295	295	295	—	—
Egypt	65	65	65	65	—	—
Libya	60	60	60	60	—	—
Other Africa	195	195	189	167	21	12.7
Africa	**615**	**615**	**609**	**587**	**21**	**3.6**
Saudi Arabia	1,460	1,460	1,460	1,460	—	—
United Arab Emirates	400	400	400	400	—	—
Other Middle East	670	670	670	571	99	17.3
Middle East	**2,530**	**2,530**	**2,530**	**2,431**	**99**	**4.1**
Australia	85	76	78	79	—	–0.5
China	180	180	180	180	—	—
India	43	42	43	44	–1	–1.7
Other Asia-Pacific	218	217	220	218	1	0.6
Asia-Pacific	**526**	**515**	**521**	**521**	**—**	**—**
TOTAL WORLD	**7,907**	**8,035**	**7,977**	**8,044**	**–68**	**–0.8**

Totals may not add due to rounding.
Source: Oil & Gas Journal.
Data available in Oil & Gas Journal Energy Database.

OXYGENATES

	June 2006	May 2006	Change	YTD 2006	YTD 2005	Change
	1,000 bbl					
Fuel ethanol						
Production	9,532	9,093	439	54,013	36,321	17,692
Stocks	6,731	7,848	–1,117	6,731	6,762	–31
MTBE						
Production	2,561	2,752	–191	17,534	19,667	–18,787
Stocks	1,912	2,314	–402	1,912	3,516	–1,604

Source: DOE Petroleum Supply Monthly. **NOTE: No new data at press time.**
Data available in Oil & Gas Journal Energy Database.

US COOLING DEGREE DAYS

	July 2006	July 2005	Normal	2006 % change from normal	Total degree days Jan. 1 through July 31 2006	2005	Normal	% change from normal
New England	260	219	180	44.4	364	345	249	46.2
Middle Atlantic	327	309	247	32.4	502	517	387	29.7
East North Central	311	295	245	26.9	491	554	443	10.8
West North Central	418	366	308	35.7	762	676	574	32.8
South Atlantic	451	462	425	6.1	1,200	1,122	1,104	8.7
East South Central	453	433	412	10.0	1,054	952	901	17.0
West South Central	580	558	545	6.4	1,706	1,494	1,402	21.7
Mountain	430	432	341	26.1	960	843	715	34.3
Pacific	308	239	188	63.8	548	389	345	58.8
US average*	**390**	**367**	**321**	**21.5**	**846**	**775**	**696**	**21.6**

*Excludes Alaska and Hawaii.
Source: DOE Monthly Energy Review.
Data available in Oil & Gas Journal Energy Database.

NOTE: No new data at press time.

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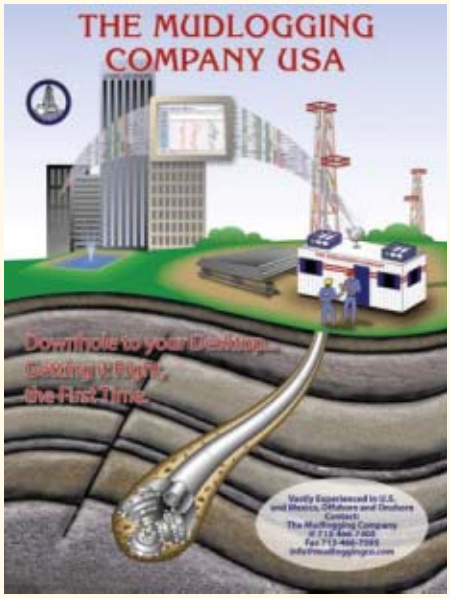

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Chavez employs 'fishing model' of geopolitics

Call it the live-bait fishing model of geopolitics: first the gift, then the gaff.

Terrorist groups use the technique in the Middle East, ingratiating themselves to the hard-pressed with medical and other services (the gift) even as they murder noncombatants they don't like (the gaff).

The groups answer complaints about the gaff by pointing to the gift.

The Editor's Perspective

by Bob Tippee, Editor

With a less deadly gaff, Venezuelan President Hugo Chavez is fishing in the US.

State-owned—meaning Chavez-dominated—Petroleos de Venezuela SA is selling heating oil at discounts through its Citgo subsidiary to poor people in the US. The program began last winter after Hurricanes Katrina and Rita disrupted Gulf Coast refining and raised fuel costs.

Citgo crows about it in a brochure on its web site entitled "From the Venezuelan Heart to the US Hearths" and featuring a photo of a sympathetic Chavez with this message: "We are all americanos, and together we share the Bolivarian mission of giving hope and a better life to the poorest and most vulnerable, whether they live in Venezuela or Vermont."

Who can argue against aid to the poor? But with the gift of cheap oil comes a gaff.

In a Sept. 15 speech at the United Nations, Chavez called US President George W. Bush "the devil." In a later speech in New York, he said he hopes Americans elect "an intelligent president" and insisted he's a friend of Americans other than those in the government.

The Venezuelan president, of course, has been wooing his country's neighbors with cut-rate oil and anti-Americanism for many months.

Traveling to the US to spit the venom was especially galling, however. If Chavez hoped to co-opt political opponents of Bush in the US, the ploy didn't work. Democrats, including House Majority Leader Nancy Pelosi of California, greeted the UN gaff as a gaffe. Pelosi called Chavez an "everyday thug."

Citgo, of course, is free to sell all the cut-rate oil Chavez wants it to in the US. Sensible Americans will take the gift and ignore the politics behind it.

As long as the gaff is only bone-headed rhetoric, they can afford to.

(Online Sept. 22, 2006; author's e-mail: bobt@ogjonline.com)

Market Journal

by Sam Fletcher, Senior Writer

Crude prices test $60/bbl floor

The October contract for benchmark US light, sweet crudes fell $2.14 to $61.66/bbl Sept. 19, the lowest closing since Mar. 21 and the largest 1-day price drop since May 15 for a front-month contract on the New York Mercantile Exchange.

The fall followed a speech to the United Nations in which US President George W. Bush appeared to back away from trade sanctions against Iran over its uranium enrichment program. However, Kevin Book at Friedman, Billings, Ramsey Group Inc. (FBR), Arlington, Va., cautioned against "relying exclusively on the public words of a national leader trying to curry favor with a room full of diplomats; we saw a much stronger tone [against Iran's nuclear program] articulated by the Department of State during a Senate hearing that took place immediately prior to the president's UN address."

Iranian President Mahmoud Ahmadinejad "may have seemed less inflammatory" in his response to Bush's speech. "But it certainly was not suggestive of a truce," Book said. "It is too soon to dismiss the Iran risk premium to crude oil. We agree that odds of an Iran-imposed embargo on its export oil appear to remain low (the US may be addicted to using oil, but Iran's government is addicted to selling it, and Ahmadinejad will not win greater support from Supreme Leader Ali Khamenei by wrecking Iran's economy). By the same token, we see several potential flash points for sanctions that could emerge from either multilateral (UN) negotiations or...the US Congress, and either one could prompt an escalation of Iranian rhetoric."

The October crude contract expired at $60.46/bbl Sept. 20. On that same date, the November contract dropped $1.43 to $60.74/bbl, but it recovered to $61.59/bbl in the next trading session on NYMEX. "Oil seems to be stabilizing amid speculation that a $60 price may be the trigger-point for the Organization of Petroleum Exporting Countries to constrict supply," said analysts in the Houston office of Raymond James & Associates Inc. on Sept. 22. The slight rebound in crude prices at the end of that week also was fueled by market suspicions that low refinery margins may induce companies to undergo larger-scale maintenance projects. "This is sparked by reports of multiple refinery shutdowns in Texas," the analysts said

OPEC no longer has a specified target range of prices for its crude. However, Iran's oil minister recently said he would like to see crude prices remain above $60/bbl.

The Energy Information Administration said US crude inventories fell 2.8 million bbl to 324.9 million bbl during the week ended Sept. 15. Gasoline stocks increased by 600,000 bbl to 207.6 million bbl, while distillate fuel inventories jumped by 4.1 million bbl to 148.7 million bbl. The average US refining margin "declined from a high of $23.50/bbl on Aug. 2 to $7.40/bbl as of Sept. 19 (the 2003-05 average was $10.70/bbl) due to rising inventories of refined products, which have increased by 9% since the beginning of May," said Jacques Rousseau, senior energy analyst at FBR.

Gas prices retreat

Natural gas futures prices retreated on NYMEX through much of September because of a milder-than-expected hurricane season and a faster-than-normal build in US gas storage to nearly full capacity. On Sept. 21, the EIA reported the injection of 93 bcf of natural gas into US underground storage facilities in the week ended Sept. 15. That was above the consensus estimate of Wall Street analysts but down from the previous week's injection of 108 bcf, with total US storage at almost 3.2 tcf. The October natural gas contract traded at $4.60-4.93/MMbtu Sept. 21 before closing at $4.78/MMbtu, down 15¢ for the day on NYMEX.

Robert S. Morris, Banc of America Securities LLC, New York, said, "We continue to believe that the near-term floor for natural gas prices will likely be set by parity with coal prices wherein some utilities could scale back coal-fired electric generation and switch to natural gas-fired units. Currently, a drop in natural gas prices to parity with coal, specifically Central Appalachian coal in the Northeast, would put Northeast prices at about $4.25-4.50/MMbtu, per our assessment, or a composite spot equivalent of $3.75-4/MMbtu."

Some industry contacts indicated switching may have already occurred, with some utilities—mostly in the Midwest—"'turning off' their oldest and least efficient coal-fired plants in favor of starting up full-cycle natural gas-fired plants or purchasing natural gas-fired power generation on the open market, although the exact amount is hard to quantify," Morris said.

If demand for less expensive natural gas increases while production decreases as US storage fills, gas supply may again tighten, analysts said.

(Online Sept. 25, 2006; author's e-mail: samf@ogjonline.com)

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- Engineers and managers who are fluent in the nuances of the Asian oil and gas E&P markets
- Field supervisors who must understand the complexities of the Asian market
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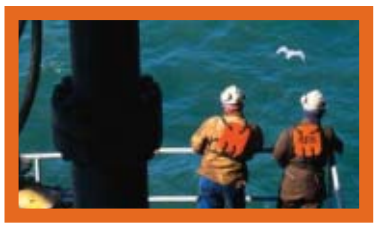

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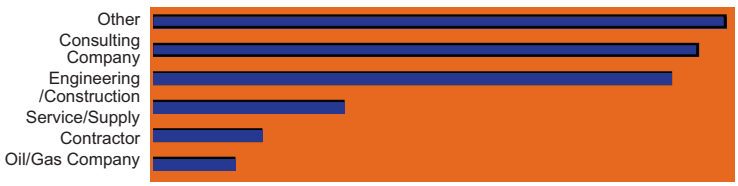
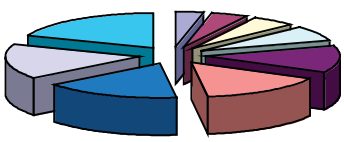


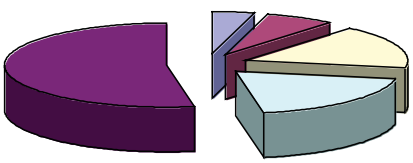
Purchasing Authority*

Attendee By Area of Interest*



- Pipeline/Transportation
- Drilling
- Exploration
- Other
- Production
- Financial
- Refining
- Petrochemical
- Gas Processing

Attendee By Job Title*



- Purchasing/Consulting
- Superintendent/Field Professional/Foreman
- Other
- Engineering/Technical /Geoscience
- Management (CEO, Pres, VP, etc)

Offshore Asia 2006 Exhibitors

Aker Kvaerner Subsea

Bayards Aluminium Constructies BV

Bayards South East Asia Pte Ltd.

Berwanger Inc.

Bridon International

Cameron

CAPE *(Construction and Piling Equipment Pte Ltd)*

CTC Marine Projects

Crane Valve Services

Dril-Quip

FMC Wellhead Equipment Sdn Bhd

FPSO Ventures Sdn Bhd

Griffin Travel Pte Ltd

JDR Cable Systems

Keppel Offshore and Marine Limited

LKT Technology Sdn Bhd

MISC Bhd *(Malaysia International Shipping Corp Bhd)*

MMHE *(Malaysia Marine and Heavy Engineering Sdn Bhd)*

Mooreast Pte Ltd

Noreva GmbH

Onne Oil and Gas Free Zone

Oil States Industries, Inc.

PennWell Corporation

PETRONAS

Petro Sakti (M) Sdn Bhd

Plimsoll Offshore & Marine Engineering Pte Ltd.

Rolls-Royce

Schlumberger Malaysia Group of Companies

Shell Malaysia

Siemens AG, Power Generation Industrial Applications

T.D. Williamson Asia Pacific Pte Ltd.

ThyssenKrupp Mannex Asia

Welltec

World Depot Sdn Bhd

Offshore Asia 2007 Preliminary Conference Program

TUESDAY, 16 JANUARY 2007

17:00 – 18:00 OPENING NIGHT EXHIBITION HALL NETWORKING RECEPTION Sponsored By: AKER KVÆRNER

WEDNESDAY, 17 JANUARY 2007

09:30 – 10:30 OPENING PLENARY SESSION

WELCOME
Eldon Ball – *PennWell Corporation*

INTRODUCTION
(speaker to be confirmed) – *PETRONAS*

REGIONAL PERSPECTIVE
Will Rowley – *Infield Systems*

KEYNOTE PRESENTATION
(speaker to be confirmed) – *Reliance Oil*

10:30 – 11:15 COFFEE BREAK Sponsored By: FMC Technologies

11:15 – 12:30 SESSION 1: PANEL DISCUSSION – PROJECT PLANNING & EXECUTION
Co-Chair: Rosli Boni – *PETRONAS*
Co-Chair: Roger Jenkins – *Murphy Oil Company*

Project Planning & Execution Lessons Learned
(speaker to be confirmed) – *PETRONAS*

Supply Chain Development in Support of Kikeh Deepwater Project
Mark Adams – *Murphy Oil Company*

Project Planning Case Histories
(speaker to be confirmed) – *Malaysia Marine and Heavy Engineering*

12:30 – 13:45 LUNCH Sponsored By: SapuraAcergy

13:45 – 15:15 SESSION 2: TRENDS IN ASIA PACIFIC E&P

Large and Novel Deepwater Subsea Production Systems
Jon Harald Kilde – *Aker Kvaerner Subsea*

Deepwater Full Field Development Contractors – How They Can Add Value to Projects
Jean-Loup Isnard – *SBM Inc.*

Malaysia's Local Content Achievements
Najib Hussin – *PETRONAS*

Operations of a Disconnectable FPSO in Cyclone Conditions
Arun Duggal – *FMC Technologies*

Offshore Asia 2007 Preliminary Conference Program

15:15 – 16:00 COFFEE BREAK Sponsored By: FMC Technologies

16:00 – 17:30 SESSION 3: FIELD DEVELOPMENT INNOVATIONS
Co-Chair: Phil Rae – *BJ Services*

Successful Batch Set Cementing in Malaysia's First Deepwater Development
Chris Flannery, Benjamin Choo and Kenneth Hampshire – *Murphy Oil Company*
Ku Ka Tong and Mark James – *Schlumberger*

Subsea Pressure Boosting for Deep/Ultradeep Installations – A Technology Overview, Applications and Field Experience
Per K. Skiftesvik – *Framo Engineering AS*

Integrating Multi Depths of Investigation Dip Data for Improved Structural Analysis – Offshore West Africa
Aimen Amer – *Schlumberger*

Deepwater Managed Pressure Drilling
Ken Muir – *Weatherford Asia Pacific Pte. Ltd.*

First Day Alternate: Delivering a HIPP's Safety Critical Control System
Adrian Phillips and Neil Douglas – *Vetco Gray Controls Ltd*

17:30 – 19:00 EXHIBITON HALL NETWORKING RECEPTION Sponsored By: MURPHY OIL CORPORATION

THURSDAY, 18 JANUARY 2007

09:30 – 11:00 SESSION 4: ADVANCES IN RISER & FLOWLINE TECHNOLOGIES
Co-Chair: Ricky Simic – *Oil States Industries*

The Challenges of Deepwater Flowlines and Risers for the Asia Pacific Region
Erik Christiani – *Acergy*

Integrity Monitoring of Deepwater Riser and Mooring Systems
Dr. Pei An – *2H Offshore Engineering Limited*

Assessing Risk and Reliability for Large vs. Many Small Projects
Prof. Peter W. Marshall, PhD, PE – *Independent*

Evolution of SCR Flexjoint® Design Methodology
Mike Hogan – *Oil States Industries*

11:00 – 11:45 COFFEE BREAK Sponsored By: FMC Technologies

Offshore Asia 2007 Preliminary Conference Program

11:45 – 13:15 SESSION 5: RISK ANALYSIS AND FACILITIES MANAGEMENT

Riser Integrity Management – Recent Industry Advancements with a Risk Based Approach
Edna O'Sullivan – *MCS*

Qualification of New Solutions and Enhancement Technologies for Riser Systems in Deepwater Frontiers
Rajiv Aggarwal – *Granherne Inc.*

Qualifying New Subsea Technology for the Deepwater Offshore Industry
Robbie Williamson – *Det Norske Veritas*

13:15 – 14:30 LUNCH Sponsored By: Schlumberger

14:30 – 15:45 SESSION 6: PANEL DISCUSSION: ADDRESSING SUSTAINABLE GROWTH ISSUES
Co-Chair: Bruce Miller – *Schlumberger*
Co-Chair: Oliver Kassam – *Acergy Group*

Strategic Planning for Sustainable Growth
Mark Adams – *Murphy Oil Company*

Managing Projects
(speaker to be confirmed) – *KBR*

Resource Management – HR
(speaker to be confirmed) – *Schlumberger*

Contracting & Bidding Strategies
(speaker to be confirmed) – *Transocean*

Resource Management
(speaker to be confirmed) – *Shell Oil Company*

Project Planning for Limited Resources
(speaker to be confirmed) – *Keppel FELS Offshore & Marine*

15:45 – 16:30 COFFEE BREAK Sponsored By: FMC Technologies

16:30 – 17:00 WRAP UP/CLOSING

DRAWING & PRESENTATION OF AWARDS
CHAIRMAN'S CLOSING REMARKS

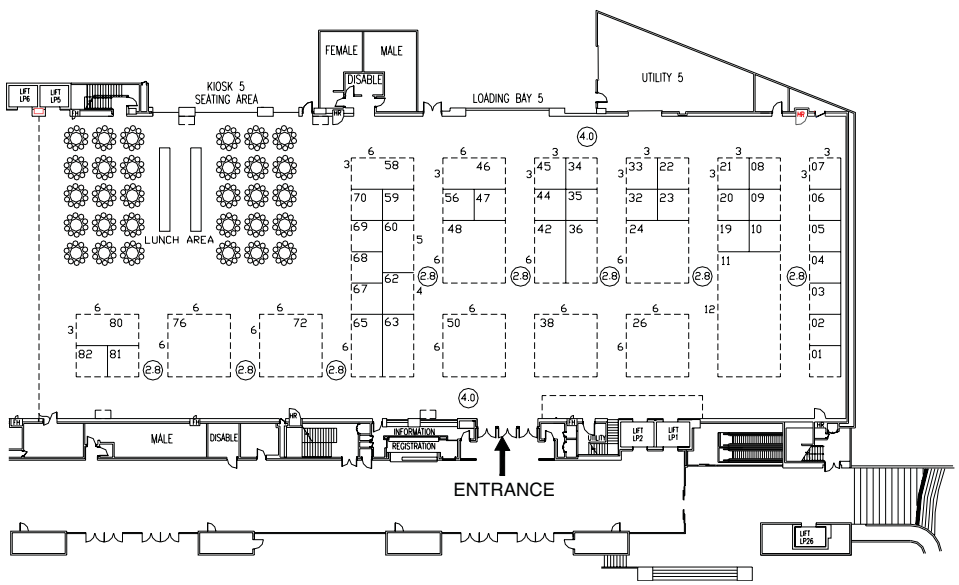
Offshore Asia

2007 Floor Plan

16-18 January 2007 • Kuala Lumpur, Malaysia
Kuala Lumpur Convention Centre

OFFSHORE ASIA™

OFFSHORE ASIA 2007
KUALA LUMPUR CONVENTION CENTRE
Exhibition Hall 5



Hall 5, Ground Floor
Kuala Lumpur Convention Centre

Offshore Asia 2007 Exhibitors

Company Name	Booth Number
Aker Kvaerner Malaysia Sdn Bhd	50
BC Petrochemical Sdn Bhd	46
Cameron	11
FMC Technologies Singapore Pte Ltd.	72
Kinetic Chemicals Sdn Bhd.	80
Oil States Industries, Inc.	63
Rolls-Royce	62
Sapura Acergy	68

Company Name	Booth Number
Schlumberger WTA (M) Sdn Bhd	38
Single Buoy Moorings	42
Tractors Petroleum Services Sdn Bhd	19
Valser Engineering & Services Sdn. Bhd	58
Veolia Water Solutions & Technologies (SEA) Pte Ltd.	65
Wood Group	48

As of September 7, 2006

Offshore Asia
2007 Registration Form

16-18 January 2007 • Kuala Lumpur, Malaysia
Kuala Lumpur Convention Centre

OFFSHORE ASIA™

First Name: _____ Last Name: _____

Title/Position: _____

Company: _____

Address: _____

City/State/Zip: _____ Country: _____ Postal Code: _____

Telephone: _____ Fax: _____

Email: _____

Registration confirmation will be sent via-email, if a unique email address is provided above.

1. Type of Company or Organization:
- ❑ 10 Oil/Gas company
- ❑ 20 Consulting Company
- ❑ 30 Contractor
- ❑ 40 Engineering/Construction
- ❑ 50 Financial
- ❑ 60 Service/Supply
- ❑ 65 Government/Library/Education
- ❑ 70 Other _____

2. Job Function:
- ❑ 02 Management (CEO, Pres.VP)
- ❑ 05 Engineering/Technical/Geoscience
- ❑ 06 Superintendent/Field Professional/Foreman
- ❑ 10 Purchasing/Consulting
- ❑ 12 Other _____

3. Areas of Interest/Involvement:
- ❑ 10 Exploration
- ❑ 05 Drilling
- ❑ 01 Production
- ❑ 29 Gas Processing
- ❑ 23 Pipeline/Transportation
- ❑ 15 Refining
- ❑ 19 Petrochemical
- ❑ 39 Financial
- ❑ 46 Other _____

4. Purchasing Role: ❑ Specify ❑ Recommend ❑ Approve ❑ None

For Information on corporate packages, contact Linda Adams
Phone: +1 918 831 9160
Email: lindad@pennwell.com

3 ways to register:

Pre-register on line before 10 January 2007.
Register on site after 10 January 2007.

1
Fax:
Direct: +1 918 831 9161
Toll-Free (US only): +1 888 299 8057

2
Website:
www.offshoreasiaevent.com

3
Mail:
PennWell C&E Registration (OA)
P.O. Box 973059
Dallas, TX 75397-3059 USA

For questions please call:
Phone: +1 918 831 9160
Toll Free (US only): +1 888 299 8016

PennWell®

Conference Fees:

1. Individual Delegate (Full Conference Registration)*
Includes:
- Access to all Conference Sessions
- Access to the Exhibition Hall, including Opening & Networking Receptions
- Coffee Breaks in Exhibition Hall
- Delegate Lunch on Wednesday and Thursday (Ticketed)
- Conference Proceedings

❑ Paid By 17 Nov. 2006 ..... US$ 750
❑ Paid After 17 Nov. 2006 ..... US$ 895

2. Corporate Plan (5 delegates)
Includes:
- Access to all Conference Sessions
- Access to the Exhibition Hall, including Opening & Networking Receptions
- Coffee Breaks in Exhibition Hall
- Delegate Lunch on Wednesday and Thursday (Ticketed)
- Conference Proceedings

❑ Paid By 17 Nov. 2006 ..... US$ 3,000
❑ Paid After 17 Nov. 2006 ..... US$ 3,580

Corporate Plan (6 to 10 delegates)
❑ Paid By 17 Nov. 2006 ..... US$ 5,250
❑ Paid After 17 Nov. 2006 ..... US$ 6,265

3. Exhibitor Delegate
Exhibit booth staff can upgrade their registration to include to access to the conference at a discounted rate
Includes:
- Access to all Conference Sessions
- Access to the Exhibition Hall, including move-in and move-out
- Access to Opening & Networking Receptions
- Coffee Breaks in Exhibition Hall
- Delegate Lunch on Wednesday and Thursday (Ticketed)
- Conference Proceedings

❑ Paid By 17 Nov. 2006 ..... US$ 370
❑ Paid After 17 Nov. 2006 ..... US$ 450

4. Single Day Conference Delegate (Wednesday OR Thursday)
Includes:
- Access to Conference Sessions on the corresponding day
- Access to the Exhibition Hall, including Opening & Networking Receptions
- Coffee Breaks in Exhibition Hall
- Luncheon on corresponding day (Ticketed)

❑ Wednesday, Paid By 17 Nov. 2006 ..... US$ 495
❑ Wednesday, Paid After 17 Nov. 2006 ..... US$ 595
❑ Thursday, Paid By 17 Nov. 2006..... US$ 495
❑ Thursday, Paid After 17 Nov. 2006 ..... US$ 595

5. Student Conference Delegate (Delegate) ..... US$ 50
Includes:
- Access to all Conference Sessions
- Access to the Exhibition Hall, including both the Opening & Networking Receptions
- Coffee Breaks in Exhibition Hall
- Delegate Lunch on Wednesday and Thursday (Ticketed)

6. Exhibit Visitor (Visitor) ..... US$ 20
Includes:
- Access to the Exhibition Hall, including Opening & Networking Receptions
- Coffee Breaks in Exhibition Hall

7. Additional Lunch Tickets (for non-delegates)
❑ Wednesday ..... ( ) @ US$ 25/day
❑ Thursday..... ( ) @ US$ 25/day

TOTAL PAYMENT AMOUNT
(In U.S. funds only) **= US$** _____

*Your full-price registration fee includes a one-year paid subscription to *Oil & Gas Journal* (US$ 69.00 value).

Payment must be received prior to the conference. If payment is not received by the conference date, the registration fee must be guaranteed on charge card until proof of payment is provided. Make check payable to PennWell/Offshore Asia 2007.

Cancellation: Cancellation of registration must be received in writing. Any individual, exhibitor, or corporate registrations cancelled before 15 December 2006 will receive a 50% refund of registration fee. After 15 December 2006, no refunds will be permitted. Substitutions may be made at any time by contacting the registration office.

Method of Payment:
❑ Check enclosed (in U.S. funds only) ❑ Wire (Wire information will be provided on invoice)
Credit Card: ❑ Visa ❑ Mastercard ❑ AMEX ❑ Discover

Credit Card Number: _____ **Expiration Date:** _____ **CVS Code:** _____

Full Name (as it appears on card)**:** _____

Card Holder Signature: _____ **Date:** _____

(Required for credit card payment)

Offshore Asia
2007 Hotel Booking Form

16-18 January 2007 • Kuala Lumpur, Malaysia
Kuala Lumpur Convention Centre

OFFSHORE ASIA™

First Name: _____ Last Name: _____

Title/Position: _____

Company: _____

Address: _____

City/State/Zip: _____ Country: _____ Postal Code: _____

Telephone: _____ Fax: _____

Email: _____ Alternate Email: _____

A copy of confirmation will be sent to each email address provided.

Nominated Hotels

☆☆☆☆☆
Mandarin Oriental Kuala Lumpur
Kuala Lumpur City Centre,
50088 Kuala Lumpur, Malaysia

- Kuala Lumpur Convention Centre Onsite Hotel
- High-speed Internet access in rooms
- 5 Restaurants, Lobby bar
- Fully equipped Fitness Center
- In-room Personal Safe
- 24-hour Room Service, Mini bar/Refrigerator
- In-room Coffee and Tea Facilities
- Business Center & Meeting Facilities

Rates	
Deluxe City View single/double occupancy	**Deluxe Premium** single/double occupancy
MYR622 $169.00 USD (approx)	**MYR733** $199.00 USD (approx)
Check in 2:00 p.m. Check out 12:00 noon	

☆☆☆☆
Crowne Plaza Mutiara Kuala Lumpur
Jalan Sultan Ismail
Kuala Lumpur, 50250 Malaysia

- Within 5 min. walk to Kuala Lumpur Convention Centre
- High-speed Internet access in rooms
- 4 Restaurants, 2 Bars, Night Club
- Health/Fitness Center
- In-room Personal Safe
- 24-hour Room Service, Mini bar/Refrigerator
- In-room Coffee Maker
- Business Center & Meeting Facilities

Rates	
Deluxe Single with Breakfast	**Deluxe Twin** with Breakfast
MYR333.50 $89.00 USD (approx)	**MYR368** $98.00 USD (approx)
Check in 2:00 p.m. Check out 12:00 noon	

Discounted rates are only available from EXTRAS, the official Offshore Asia housing service.
Visit www.offshoreasiaevent.com to reserve your rooms online or return completed form to EXTRAS information at the bottom of the page.

Please choose one: ☐ Attendee ☐ Exhibit Visitor ☐ Exhibitor

Hotel Request

	Name	Additional names for double or twin occupancy:	Room Type:
Guest 1	_____	_____	☐ Deluxe City View ☐ Deluxe Premium ☐ Deluxe Single ☐ Deluxe Twin ☐ Smoking ☐ Non-smoking
	Hotel Preference: ☐ Mandarin Oriental Kuala Lumpur ☐ Crowne Plaza Mutiara Kuala Lumpur		
	Arrival _____ /_____ / 2007 Departure _____ /_____ / 2007		
Guest 2	_____	_____	☐ Deluxe City View ☐ Deluxe Premium ☐ Deluxe Single ☐ Deluxe Twin ☐ Smoking ☐ Non-smoking
	Hotel Preference: ☐ Mandarin Oriental Kuala Lumpur ☐ Crowne Plaza Mutiara Kuala Lumpur		
	Arrival _____ /_____ / 2007 Departure _____ /_____ / 2007		
Guest 3	_____	_____	☐ Deluxe City View ☐ Deluxe Premium ☐ Deluxe Single ☐ Deluxe Twin ☐ Smoking ☐ Non-smoking
	Hotel Preference: ☐ Mandarin Oriental Kuala Lumpur ☐ Crowne Plaza Mutiara Kuala Lumpur		
	Arrival _____ /_____ / 2007 Departure _____ /_____ / 2007		

Payment Information

Credit Card details required to guarantee the Hotel Reservation. Payment will not be expected until departure.

☐ Visa ☐ Mastercard ☐ AMEX

Credit Card Number: | | | | | | | | | | | | | | | | **Expiration Date:** | | | | **CVS Code:** | | |

Full Name (as it appears on card): _____

Card Holder Signature: _____ **Date:** _____

(Required for credit card payment)

FOR MORE INFORMATION

In the U.S. EXTRAS:
Phone: 800 507 8010 Direct: 770 944 0331
Fax: 800 520 8314 Direct: 770 234 6161

In Asia/Hong Kong EXTRAS:
Phone: +852 817 00175
Fax: +852 301 00481

In Europe/UK EXTRAS:
Phone: +44 (0)20 7871 4605
Fax: +44 (0)20 7022 1563

Offshore Asia
2007 Exhibit Space Agreement

16-18 January 2007 • Kuala Lumpur, Malaysia
Kuala Lumpur Convention Centre

OFFSHORE ASIA™

Exhibitor named below hereby applies for exhibit space at the Exhibition described above. Enclosed with this form is a deposit for 50% of the total booth/space rental. By signing below, Exhibitor agrees that this deposit is ***NON-REFUNDABLE***. If the 50% deposit did not accompany submission of this form, Exhibitor agrees to pay such deposit within 30 days of invoice. Exhibitor also agrees to pay the remaining 50% fee on invoice and not later than 13 October 2006 ***WITHOUT REFUND*** except as otherwise expressly stated in Section 9 on the back of this form.

Exhibiting company: _____

Physical address (for shipments): _____

Mailing address: _____

City/State/Zip: _____ Country: _____ Postal code: _____

Contact for exhibit arrangements: _____ Title: _____

Telephone: _____ Fax: _____

Email: _____ Website address: _____

Exhibitor's signature below signifies that Exhibitor has read, understands, and agrees to be bound by all the terms and conditions on the front and back of this form (including the EXHIBITION RULES, REGULATIONS, AND ADDITIONAL CONDITIONS, which constitute part of this Agreement). Also, by signing below, Exhibitor acknowledges that if Exhibitor has deemed it necessary or desirable, Exhibitor has raised and obtained satisfactory answers to any questions about the clarity, legibility or readability of the form.

SIGN HERE

Signer's full name: _____ Title: _____

Signature: _____ Date: _____

Exhibit Requirements:

❑ Space Only Exhibitor requires _____ square meters (minimum 9 m^2) of exhibit space. Space Only rate is US$425 per square meter.

❑ Shell Scheme Exhibitor requires _____ square meters (minimum 9 m^2) of exhibit space. Shell Scheme space rate is US$495 per square meter. Shell scheme includes 3 side panels (2 side panels for corner booth), needle punch carpet, 1 information counter, 1 fascia board with company text, 1 electrical point, 2 fluorescent lights/spotlights, 1 table, 2 chairs, 1 waste basket.

1st Booth Choice _____ 2nd Choice _____ ❑ Best Available Total Cost $ _____

Please do not locate me near any of these exhibitors: _____ 50% Deposit Enclosed $ _____

Method of Payment:
Please check appropriate box. ❑ Check ❑ Wire Transfer
Credit Card: ❑ VISA ❑ MasterCard ❑ AMEX ❑ Discover

Mailing Address for Checks:
PennWell Corporation, PO Box 973046, Dallas, TX 75397-3046
Please indicate event and invoice number.

Please send US wire transfer payments only to:
JPMorgan Chase Bank N.A., 300 South Riverside, 17th Floor, Chicago, IL 60606 | ABA Number: 021000021 | SWIFT Code: CHASUS33
Account Name: PennWell Corporation | Account Number: 1009752

Please send non-US wire transfer payments only to:
JPMorgan Chase Bank N.A., P.O. Box 4972, 1 Chaseside, Bournemouth, BH7 7WH, United Kingdom | SWIFT Code: CHASGB2L | Account Name: PennWell Corporation
US Dollars Account Number: 77033003 | Euro Account Number: 77033001 | GBP Account Number: 77033002

Credit Card Number: | | | | | | | | | | | | | | | | | | **Expiration Date:** | | | |

Full Name (as it appears on card)**:** _____

By signing below, Card Holder acknowledges that he/she has read the front and back of this form, and agrees to be bound by all its terms and conditions. Card Holder's signature also acknowledges that if Card Holder has felt it necessary or desirable, Card Holder has asked about anything unclear, illegible, or unreadable in this form (front or back), and has obtained answers that Card Holder regards satisfactory. Card Holder authorizes (and agrees not to dispute) charges up to the amount of this agreement at anytime from the date of submission of this form through the closing of this Show.

Card Holder Signature: _____ **Date:** _____

Return to Offshore Asia 2007

Attn: Michael Yee: Tel: +65 9616 8080; Fax: +65 6734 0655; Email: yfyee@singnet.com.sg
c/o PennWell Corporation; 19 Tanglin Road #09-07 Tanglin Shopping Center;
Singapore 247909; Republic of Singapore

For Show Management Only

Attn: Sue Neighbors; Tel: (713) 963-6256; Fax: (713) 963-6212
or **Dawn Peek**; Tel: (713) 963-6213; Fax: (713) 963-6201
1700 West Loop South, Suite 1000; Houston, Texas 77027 USA

Date Received: _____ Amount Received: $_____ Amount Due: $_____ Customer #_____

Booth Assigned: _____ Accepted For OA 2007 By: _____ Print Name: _____

PennWell

Offshore Asia
2007 Exhibit Space Agreement

16-18 January 2007 • Kuala Lumpur, Malaysia
Kuala Lumpur Convention Centre

1. Offer and Acceptance. Exhibitor's submission of the 2007 Exhibit Space Agreement form, with or without a deposit, shall constitute an offer from Exhibitor to enter into such Agreement with PennWell Corporation, acting through its PennWell UK Group ("PennWell"). Such offer can only be accepted by PennWell's signing such Agreement at PennWell's place of business in Tulsa, OK, USA or Upshire, Essex, UK. After signing in Tulsa or Essex, PennWell will send to Exhibitor a fully signed copy of the one-page (front and back) Agreement document, which sending shall constitute PennWell's acceptance and cause the Agreement as a whole to become effective.

2. Arrangements of Exhibits. Exhibits shall be so arranged as not to obstruct the general view nor hide the exhibits of others. Plans for specially built displays not in accordance with these Exhibition Rules and the regulations set forth in the Exhibitor Service Kit must be submitted to Show Management before construction is ordered and/or begun. The Exhibitor Service Kit will be supplied to Exhibitor approximately four months before the Exhibition. With or without prior inspection, Exhibitor understands that by signing the 2007 Exhibit Space Agreement form, Exhibitor agrees to be bound by the Exhibitor Service Kit, which shall form part of the Agreement.

3. Soliciting/Photographs. Exhibitor is prohibited from distributing (i) literature, souvenirs, or other items from outside the boundaries of Exhibitor's booth, and (ii) literature, souvenirs, or other items that are other than Exhibitor's own materials; in each case, unless Exhibitor has obtained Show Management's prior written approval. These prohibitions apply before, after, or during Exhibition hours. Canvassing in exhibit halls or distribution of advertising matter, souvenirs, or any other items whatsoever by anyone who is not a paid exhibitor is strictly forbidden. Exhibitor is prohibited from taking photographs of other exhibits or other aspects of the Exhibition, without Show Management's prior written approval. Exhibitors may photograph only their own booth(s).

4. Exhibitor Personnel and Others. Technical specialists, qualified to discuss engineering details of their products, must man booths at all times during Exhibition hours. Show Management reserves the right to prohibit an exhibit or part of an exhibit that, in Show Management's sole discretion, may detract from the character or nature of the Exhibition.

5. Remedies. If Exhibitor fails to make any payment or otherwise breaches any provision of the Agreement, and fails to cure within a reasonable time (as defined in the next sentence) after Exhibitor has received written notice from Show Management specifying the breach, Show Management shall have the right to exercise (without further notice) any one or more of the following remedies at any time after such reasonable time has passed: (i) cancel the Agreement in whole or in part; (ii) evict Exhibitor from any or all of the space being rented by Exhibitor; (iii) have any of the Agreement's violated provisions specifically enforced; and/or (iv) exercise any other remedy available by rule of law. "Reasonable time" means: (i) immediately in the case of any breach occurring during the Exhibition; (ii) 24 hours, in the case of any failed payment and (iii) 5 days, in the case of any other breach. In addition, Show Management may keep any and all monies received from Exhibitor as liquidated damages, it being understood that PennWell's losses and damages from Exhibitor's breach of the Agreement as well as a precise value for services provided by PennWell prior to the conclusion of the Exhibition are difficult to ascertain and that the agreed liquidated damages are not intended and may not be construed as a penalty. Upon cancellation of the Agreement, Show Management may (without prejudice to any other available remedy) rent Exhibitor's space to any other exhibitor, or use such space in any other manner as Show Management deems necessary, in its sole discretion, without any obligation to Exhibitor.

6. Unoccupied Space. If any of Exhibitor's space remains unoccupied on opening day of the Exhibition, Exhibitor shall be deemed to have abandoned such space. Thereafter, Show Management shall have the right to rent such space to any other exhibitor, or use such space in any other manner as Show Management deems necessary, in its sole discretion, without any obligation to Exhibitor. This Section shall not be construed as affecting the obligation of Exhibitor to pay the full amount specified in the Agreement for space rental.

7. Liability. Neither Show Management nor its agents or representatives will be responsible for any injury, loss, or damage that may occur to Exhibitor or to Exhibitor's employees, invitees, licensees, or guests, or Exhibitor's property, from any cause whatsoever. Under no circumstances shall Show Management or its agents or representatives be liable for (i) any special, indirect, incidental, or consequential loss or damage whatsoever, or (ii) any loss of profit, loss of use, loss of opportunity, or any cost or damage resulting from any such loss. Exhibitor acknowledges that the risk allocations of this Section are reasonable based on the understanding that Exhibitor shall obtain, at its own expense, adequate insurance against any such injury, loss, or damage. Show Management shall not be liable for failure to perform its obligations under the Agreement as a result of strikes, riots, acts of God, or any other cause beyond its control. Anyone visiting, viewing, or otherwise participating in Exhibitor's booth or exhibit is deemed to be the invitee, licensee, or guest of Exhibitor, and not the invitee, licensee, or guest of Show Management. Exhibitor assumes full responsibility and liability for the actions of its agents, employees, independent contractors, or representatives, whether acting within or without the scope of their authority, and agrees to defend, indemnify, and hold PennWell, the exhibition hall, and their respective privies, harmless from and against claims resulting directly or indirectly from the actions or omissions of Exhibitor and/or Exhibitors agents, employees, independent contractors, or representatives, whether within or without the scope of authority. There is no other agreement or warranty between Exhibitor and Show Management except as set forth in this document and the Exhibitor Service Kit. The rights of Show Management under the Agreement shall not be deemed waived except through writing signed by an authorized officer of Show Management.

8. Insurance. For the term of the Agreement, Exhibitor shall at all times maintain insurance sufficient to cover the liabilities of Exhibitor under the Agreement. The amount and scope of such insurance shall be reasonably satisfactory to Show Management. Such insurance shall also provide coverage for Exhibitor's contractual obligations to defend, indemnify, and hold harmless, as stated in the Agreement. Show Management shall be added as an additional insured to such insurance. Exhibitor's insurer shall confirm to Show Management that such insurance cannot be cancelled or changed without thirty (30) days prior written notice to Show Management. Exhibitor agrees to provide Show Management a suitable certificate verifying that the required insurance is and will remain in force for the duration of the Exhibition.

9. Force Majeure. In case the Exhibition hall is damaged or destroyed by fire, the elements, or any other cause, or if circumstances make it unreasonably difficult for Show Management to permit Exhibitor to occupy the assigned space during any part or the whole of the Exhibition, then during such circumstances Show Management, the building management, and their respective privies will be released and discharged from the obligation to supply space, and Exhibitor will be reimbursed a proportionate share of the booth rental previously received by Show Management from Exhibitor. PennWell reserves the right to cancel, re-name, or relocate the Exhibition or change the dates on which it is held. If PennWell changes the name, relocates to another facility within the same city, or changes the dates for the Exhibition to dates that are not more than 30 days earlier or later than the dates originally scheduled, no refund will be due Exhibitor and PennWell shall assign to Exhibitor such other space as PennWell deems appropriate. In such case, Exhibitor agrees to use such space under the terms of the Agreement.

10. Jurisdiction and Attorney Fees. Should any legal action be commenced to resolve any dispute under the Agreement: (i) Exhibitor hereby consents to venue and jurisdiction in the federal or state courts located in Tulsa, Oklahoma (headquarters of PennWell), and agrees that no such action may be brought in a forum not located in Tulsa, Oklahoma; and (ii) the prevailing party shall be entitled to an award of litigation expenses, interest, and reasonable attorney fees, in addition to any other remedy obtained.

11. Taxes and Licenses. Exhibitor shall be responsible for obtaining any licenses, permits, or approvals required under local, city, state, or national law applicable to Exhibitor's activity at the Exhibition. Exhibitor shall be responsible for obtaining any tax identification numbers and paying all taxes, license fees, use fees, or other charges that may become due to any governmental authority concerning Exhibitor's activities related to the Exhibition.

12. Cancellations. In the event that Exhibitor wishes to cancel some or all of its allotted exhibit space, Exhibitor may request and Show Management may grant such cancellation, but only with the following understandings; (i) all cancellations must be requested in writing and addressed to PennWell Petroleum Group at the address below; (ii) Show Management is not required to refund any portion of moneys (the 50% deposit, full fee, or otherwise) previously paid by Exhibitor; (iii) if Exhibitor's cancellation request is received by Show Management after the Agreement has become effective, Exhibitor nevertheless agrees to pay the full fee based on the original space requirements, before such cancellation will become effective. Show Management assumes no responsibility for having included the name of Exhibitor in the Exhibition catalog, brochures, news releases, or other materials.

13. Changes. If Exhibitor requests an increase of its booth space after the Agreement has become effective, Show Management will use reasonable best efforts to accommodate such request, subject to space availability, additional fee payment, and other circumstances then prevailing. If Exhibitor requests a change that leads to a net reduction of booth space from original requirements, such request shall be covered by Section 12 above.

14. Other Matters. The Exhibition is owned and managed by PennWell Corporation, acting through its Petroleum Group whose main office is at PennWell 1700 West Loop South, Suite 1000; Houston, TX 77027 USA. All matters not expressly covered in the Agreement are subject to the reasonable decision of the Show Management, which decision shall be final.

By initialling below, Signer signifies that Exhibitor has read, understands, and agrees to be bound by all the terms and conditions set forth above.

_____ (signer's initials) for _____ (Exhibitor)

PennWell

Offshore Asia
2007 Advertising Space Agreement

16-18 January 2007 • Kuala Lumpur, Malaysia
Kuala Lumpur Convention Centre

OFFSHORE ASIA™

I/we hereby apply for advertising space in the official Offshore Asia Conference Program.

❑ Ad in final program (material due November 10, 2006) Date: _____

Contact Name: _____ Company Name: _____

Address: _____

City/State: _____ Zip/Postal code: _____

Country: _____

Contact Telephone: _____ Contact Fax: _____

Contact Email: _____

Signature: _____ Date: _____

Black & white advertising rates:

Full-page	US$	1,725
Two-page spread	US$	3,165
1/2 page	US$	980
1/4 page	US$	575

Cover position (full-page only) ADD 20%

Color charges:

One standard color, each per page	US$	350
Matched color, each per page	US$	530
Four-color process, per page	US$	1,095
Four–color process, per fraction	US$	500
Spread four-color	US$	1,850

Advertising Requirements

(please check appropriate boxes):

Full-page ad	❑ b/w	❑ 4-c process
Two-page spread	❑ b/w	❑ 4-c process
1/2 page	❑ b/w	❑ 4-c process
1/4 page	❑ b/w	❑ 4-c process

Cover position ❑ Inside front ❑ Inside back ❑ Back cover

Total Cost US$ _____

Printing and Production Specifications:

Trim Size: 8" x 10.5" (203mm x 266mm). Allow .25" (6.3mm) within final trim and gutter for live text, headings, etc.

1 page/full page
7" x 10"/178 mm x 254 mm

1 page/full page bleed
8.25" x 10.75"/210 mm x 273 mm

2 page spread
15" x 10"/381 mm x 254 mm

2 page spread bleed
16.25" x 10.75"/413 mm x 273 mm

1/2 page horizontal
7" x 4.88"/178 mm x 124 mm

1/2 page horizontal bleed
8.25" x 5.63"/210 mm x 141 mm

1/2 page vertical
3.38" x 10"/86 mm x 254 mm

1/2 page vertical bleed
4.13" x 10.75"/105 mm x 273 mm

1/4 page
3.38" x 4.88"/86 mm x 124 mm

Offset Film Requirements:

Printing materials required: Negatives (right reading, emulsion side down); **Screen:** 133. SWOP Specifications apply as listed in SRDS Print Media Production Data. Copy of complete listing is available upon request. If materials other than negatives are furnished, additional charges may be incurred for making negatives, pulling proofs, and express delivery.

Submission of Electronic Advertisement Files:

With your zip disk or CDRom, provide one high-end match color quality proof. This can include Iris, Fuji, Kodak Approval, Creo Spectrum, Matchprint, Cromalin, etc. Indicate color makeup on proof (i.e., CMYK; CMYK and PMS 280; K and PMS 280, etc.). If a proof, other than one of the types listed here is provided, an additional charge for creating a preferred proof will be incurred.

Current Programs Supported

- QuarkXpress: Use the collect-for-output function of Quark to extract your document and artwork to the disk sent. Quark does not collect fonts, so these must be collected and provided. Make certain all colors are CMYK or Pantone spot colors.
- PageMaker: Be certain all artwork and fonts are included.
- Adobe Illustrator: Save any graphics in the EPS format with fonts included. Set all colors to CMYK or Pantone spot colors.
- Adobe PhotoShop: Save as EPS files in CMYK format with preview of 8 bits/pixel and binary encoding.
- Adobe InDesign: Include all artwork and fonts. Colors must be CMYK or Pantone spot colors.

RESOLUTION MUST BE A MINIMUM 254 pixels/in. (100 pixels/cm).
Other programs (Microsoft Word, Power Point, Corel Draw) are not supported.

Send Materials to Offshore Asia 2007/Attn: Isabelle Dessaux

1700 West Loop South, Suite 1000 • Houston, Texas 77027 USA
Telephone (713) 963-6236 • Fax (713) 963-6212 • Email: isabelle@pennwell.com

Return to Offshore Asia 2007

Attn: Michael Yee: Tel: +65 9616 8080; Fax: +65 6734 0655; Email: yfyee@singnet.com.sg
c/o PennWell Corporation; 19 Tanglin Road #09-07 Tanglin Shopping Center;
Singapore 247909; Republic of Singapore

For Show Management Only

Attn: Sue Neighbors; Tel: (713) 963-6256; Fax: (713) 963-6212
or **Dawn Peek**; Tel: (713) 963-6213; Fax: (713) 963-6201
1700 West Loop South, Suite 1000; Houston, Texas 77027 USA

Date Received: _____ Amount Due: $_____ Customer #_____

Accepted For OA By: _____ Print Name: _____

PennWell

OFFSHORE ASIA™

16-18 January 2007 · Kuala Lumpur, Malaysia
Kuala Lumpur Convention Centre

For more information visit us online at www.offshoreasiaevent.com or contact:

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Phone: +44 (0) 1992 656 630
Fax: +44 (0) 1992 656 700
Email: oainfo@pennwell.com

International Event Operations Manager:
Koula Karayianni
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Fax: +1 918 831 9161
Toll Free: +1 888 299 8016
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Exhibitor/Sponsorship Sales Managers

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Email: yfyee@singnet.com.sg

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