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Practical Drilling Technology

Oil industry has new risk factor: terrorism
Pinedale, Jonah gas fields see expanding development
Aromatics increase rvp blending value
Chemicals improve compressed-air crude line cleaning

OIL&GAS JOURNAL®

Mar. 3, 2008
Volume 106.9

PRACTICAL DRILLING TECHNOLOGY

REGULAR FEATURES

COVER

Equipment innovation and building programs continue to supply new tools and drilling rigs to the industry. The special report begins on p. 41, describing the first of four new jack ups under construction for Maersk Contractors. Researchers consider alternate materials to source drilling consumables, such as aluminum pipe and tubulars, in an article beginning on p. 46. On the cover, Pioneer Natural Resources Co. drills the Hansen No. 1A-L1 well in August 2007 with Rowan Drilling Co. Inc.'s Rig 68 on Alaska's Kenai Peninsula. The well reached TD at 22,650 ft, with a 5,800-ft lateral section. Pioneer tested oil in one new zone in this Cosmopolitan unit well in the Cook Inlet. Photo by David Hart, Pioneer Natural Resources.

General Interest

Exploration & Development

Drilling & Production

Processing

Transportation

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PennWell, Houston office

1455 West Loop South, Suite 400, Houston, TX 77027
Telephone 713.621.9720/Fax 713.963.6285/Web site www.ogjonline.com
Editor Bob Tippee, bobt@ogjonline.com
Chief Editor-Exploration G. Alan Petzet, alanp@ogjonline.com
Chief Technology Editor-LNG/Gas Processing Warren R. True, warrent@ogjonline.com
Production Editor Guntis Moritis, guntism@ogjonline.com
Drilling Editor Nina M. Rach, ninar@ogjonline.com
Refining/Petrochemical Editor David N. Nakamura, davidn@ogjonline.com
Pipeline Editor Christopher E. Smith, chriss@ogjonline.com
Senior Editor-Economics Marilyn Radler, marilynr@ogjonline.com
Senior Editor Steven Poruban, stevenp@ogjonline.com
Senior Associate Editor Judy R. Clark, judyrc@ogjonline.com
Senior Writer Sam Fletcher, samf@ogjonline.com
Senior Staff Writer Paula Dittrick, paulad@ogjonline.com
Survey Editor Leena Koottungal, lkoottungal@ogjonline.com
Editorial Assistant Linda Barzar, lbarzar@pennwell.com

Petroleum Group President Michael Silber, msilber@pennwell.com
Vice-President/Group Publisher Bill Wageneck, billw@pennwell.com
Vice-President/Custom Publishing Roy Markum, roym@pennwell.com

PennWell, Tulsa office

1421 S. Sheridan Rd., Tulsa, OK 74112
PO Box 1260, Tulsa, OK 74101
Telephone 918.835.3161 / Fax 918.832.9290
Presentation/Equipment Editor Jim Stilwell, jims@ogjonline.com
Associate Presentation Editor Michelle Gourd, michelleg@pennwell.com
Statistics Editor Laura Bell, laurab@ogjonline.com
Illustrators Alana Herron, Kermit Mulkins, Mike Reeder, Kay Wayne
Editorial Assistant Donna Barnett, donnab@ogjonline.com
Production Director Charlie Cole

London

Tel +44 (0)208.880.0800
International Editor Uchenna Izundu, uchennai@pennwell.com

Washington

Tel 703.963.7707
Washington Editor Nick Snow, nicks@pennwell.com

Los Angeles

Tel 310.595.5657
Senior Correspondent Eric Watkins, hippalus@yahoo.com

OGJ News

Please submit press releases via e-mail to: news@ogjonline.com

Subscriber Service

P.O. Box 2002, Tulsa OK 74101
Tel 1.800.633.1656 / 918.831.9423 / Fax 918.831.9482
E-mail ogjsub@pennwell.com
Circulation Manager Tommie Grigg, tommieg@pennwell.com

PennWell Corporate Headquarters

1421 S. Sheridan Rd., Tulsa, OK 74112

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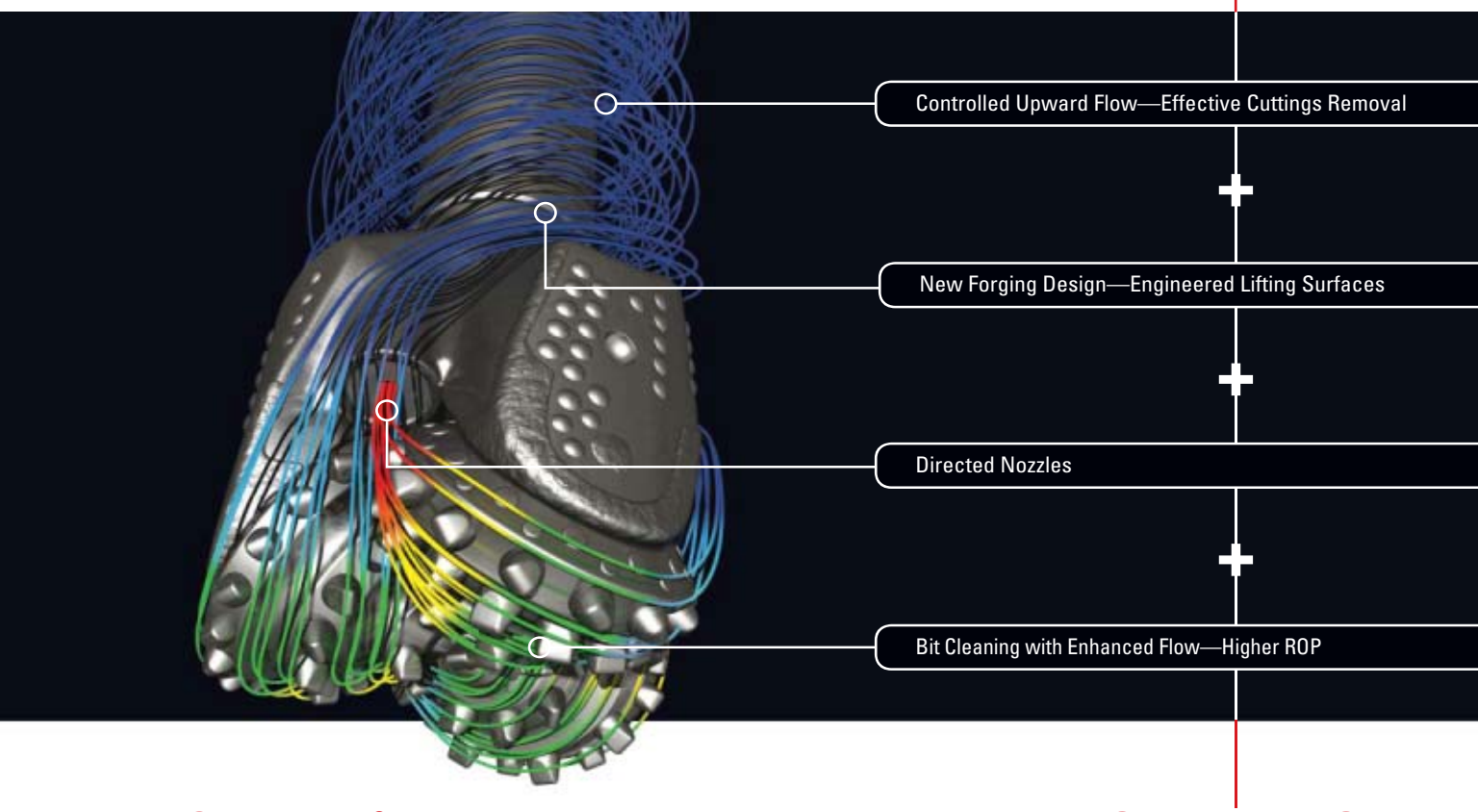

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Mar. 3, 2008

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General Interest — Quick Takes

Ecuador hails 'integration' with Venezuela

Ecuadorian President Rafael Correa, while accepting drilling services offered by Venezuela at a discounted rate, has hailed his country's oil and gas "integration" with its South American neighbor.

State-owned Petroecuador will use two Venezuelan rigs, one of which is drilling the Guanto Dureno well in the province of Lago Agrio. The other is to arrive next month.

Petroecuador and Petroleos de Venezuela SA also will establish a joint company for development of Sacha oil field and in June will begin construction of a 300,000-b/d refinery in the province of Manabi.

The Ecuadorian leader cited the support of Venezuelan President Hugo Chavez in offering the two oil rigs and accompanying technicians at a discounted rate, covering all expenses for maintenance, operations, and administration.

Correa said the rig's rental came to $8,000/day, compared with what he called the international market rate of $30,000/day. He also pledged that Petroecuador's crude oil production would eventually increase to 190,000 b/d from 173,000 b/d.

Taxes, mature fields vex Russia's oil industry

High taxes are threatening the future development of Russia's oil and gas industry as production growth stagnates from mature fields, speakers warned last month at International Petroleum Week in London.

"There is no clarity until the new government comes into power," said Tony Considine, TNK-BP downstream executive vice-president.

Russia's prospective fields in Siberia and offshore in the Arctic require huge investments and pose major development and financial risks.

Favorable tax rules make it attractive for companies to invest in refining rather than export the oil. Russia also has encouraged the creation of petroleum products because it adds value to oil. About 100 mini refineries have sprung up, but future growth is being jeopardized by a shortage of skilled personnel and a lack of financial investment, Considine said. "We are cautiously optimistic; we can be competitive with European refineries if oil prices are at $60/bbl."

Refiners are under great pressure to change the specification of petroleum products in Russia, with different requirements set for 2009, 2010, and 2013, Considine said, criticizing the timetable as "aggressive."

Mark Gyetvay, chief financial officer of Russian gas independent Novatek, told OGJ it does not expect the forthcoming government to severely increase mineral extraction taxes, as large investments are required for projects. None of the presidential candidates, who will finish their campaigns in March, has indicated that he would change the investment climate to benefit independents, which are expected to be important players in supplying oil and gas to the market in the midterm.

"Gazprom's supply will be relatively flat because a lot of these projects won't start until 2013, and they are capital intensive projects, so the growth in Russia will be driven by the independents," he added.

Novatek represents 29% of non-Gazprom production, a volume expected to rise to 40% within the next 5 years. Novatek enjoys higher-than-average gas prices on the domestic market because it does not have to sell gas at fixed prices as Gazprom does.

Gyetvay said Gazprom has purchased gas from Central Asia to supply its customers, but these countries also are pursuing strategies to export gas to Asia and bypass Russia, leaving the market unclear about the level of Central Asian gas available.

NOCs, IOCs need to find new partnership models

National oil companies are delivering higher levels of growth in market capitalization compared with international oil companies, and new models of collaboration are necessary to deliver secure and sustainable energy supplies to the global market, speakers told delegates last month at International Petroleum Week in London.

In 2007 NOCs held 65% of the world's reserves, offering limited equity access, according to Robin West, chairman of consultancy PFC Energy. Full IOC access to reserves was 7%. "It's their oil," West said, "and this is the new reality."

By 2030, global energy demand is expected to increase by 40% compared with 2008—driven mainly by economic growth and population increases in developing countries, according to ExxonMobil Corp. figures. The growth of the transportation sector will account for the rise over the next 2 decades, with oil remaining a crucial part of the energy mix.

Because of high oil prices, producing countries are awash with cash and are confident about developing energy projects without the assistance of IOCs. However, they are seeking technology transfers, skills training, infrastructure support, and economic development.

Tighter fiscal regimes are making it more difficult for IOCs to propose economically attractive projects. West called on IOCs to find ways to align themselves with building the gross national products of their host governments in accessing new resources. He told OGJ that BP PLC has found ways to develop the infrastructure in Azerbaijan to help grow its economy. ✦

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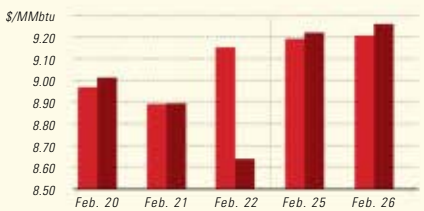
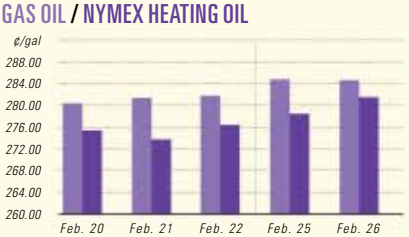


IPE GAS OIL / NYMEX HEATING OIL



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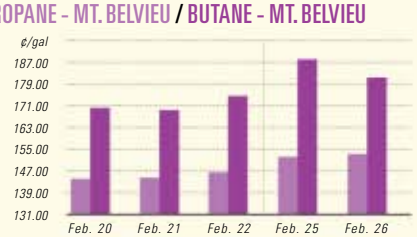
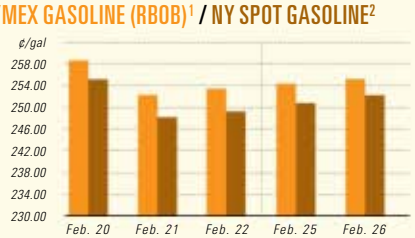


NYMEX GASOLINE (RBOB)[1] / NY SPOT GASOLINE[2]



[1]Reformulated gasoline blendstock for oxygen blending.
[2]Non-oxygenated regular unleaded.

US INDUSTRY SCOREBOARD — 3/3

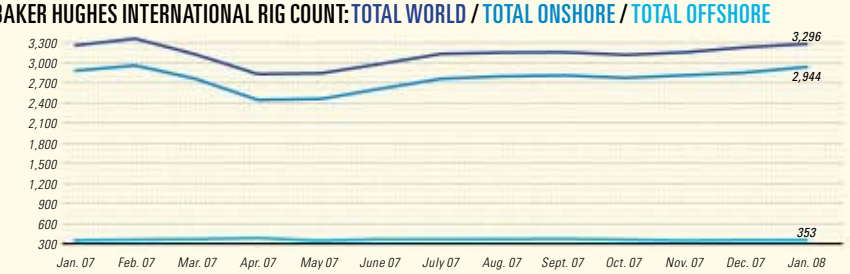
Latest week 2/15	4 wk. average	4 wk. avg. year ago[1]	Change, %	YTD average[1]	YTD avg. year ago[1]	Change, %
Demand, 1,000 b/d						
Motor gasoline	9,000	8,958	0.5	9,055	8,958	1.1
Distillate	4,349	4,434	–1.9	4,312	4,434	–2.8
Jet fuel	1,570	1,626	–3.4	1,559	1,626	–4.1
Residual	673	849	–20.7	731	848	–13.8
Other products	5,084	5,048	0.7	5,087	5,049	0.7
TOTAL DEMAND	20,676	20,915	–1.1	20,744	20,915	–0.8
Supply, 1,000 b/d						
Crude production	5,022	5,172	–2.9	5,028	5,172	–2.8
NGL production[2]	2,609	2,235	16.7	2,451	2,235	9.6
Crude imports	10,102	9,621	5.0	10,109	9,650	4.8
Product imports	3,621	3,275	10.6	3,475	3,283	5.9
Other supply[3]	852	1,007	–15.4	1,039	1,046	–0.7
TOTAL SUPPLY	22,206	21,310	4.2	22,102	21,386	3.3
Refining, 1,000 b/d						
Crude runs to stills	14,834	14,560	1.9	14,834	14,712	0.8
Input to crude stills	15,015	15,293	–1.8	15,015	15,087	–0.5
% utilization	86.1	87.8	—	86.1	86.4	—

Latest week 2/15	Latest week	Previous week[1]	Change	Same week year ago[1]	Change	Change, %
Stocks, 1,000 bbl						
Crude oil	305,274	301,070	4,204	327,583	–22,309	–6.8
Motor gasoline	230,264	229,236	1,028	222,115	8,149	3.7
Distillate	122,527	126,973	–4,446	128,290	–5,763	–4.5
Jet fuel-kerosine	39,803	41,093	–1,290	39,133	670	1.7
Residual	36,915	36,893	22	38,666	–1,751	–4.5
Stock cover (days)[4]			Change, %		Change, %	
Crude	21.0	20.6	1.9	22.3	–5.8	
Motor gasoline	25.6	25.6	—	24.4	4.9	
Distillate	28.2	30.0	–6.0	27.5	2.5	
Propane	20.5	21.7	–5.5	18.6	10.2	

Futures prices[5] 2/22			Change		Change	%
Light sweet crude, $/bbl	99.45	94.12	5.33	58.51	40.84	69.7
Natural gas, $/MMbtu	9.00	8.56	0.44	7.33	12.67	22.8

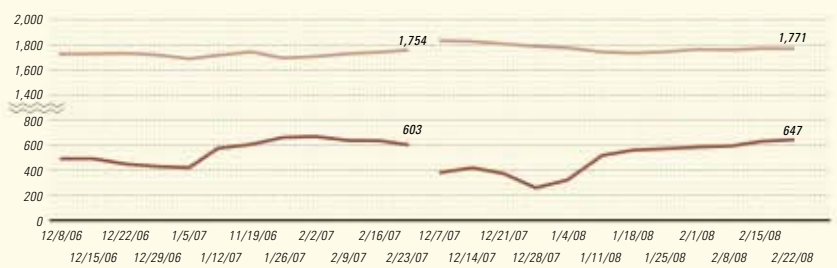
[1]Based on revised figures. [2]Includes adjustments for fuel ethanol and motor gasoline blending components. [3]Includes other hydrocarbons and alcohol, refinery processing gain, and unaccounted for crude oil. [4]Stocks divided by average daily product supplied for the prior 4 weeks. [5]Weekly average of daily closing futures prices.
Sources: Energy Information Administration, Wall Street Journal

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

Exploration & Development — *Quick Takes*

Tullow gauges light oil discovery off Ghana

Tullow Oil PLC said it gauged light, 29° gravity oil in the Gulf of Guinea off Ghana in an exploratory well that opens a new play.

The Odum-1 discovery on the West Cape Three Points License is a stratigraphic trap in a Campanian age fan system and opens a second new play fairway in the Tano basin, the company said. The company has identified further prospectivity in the Campanian play on the West Cape Three Points and Deepwater Tano licenses.

Odum-1, drilled to 3,387 m in 955 m of water 13 km from Jubilee field, encountered 22 m of net pay in a 60-m gross oil column. It is suspended as a future development well.

The Songa Saturn drillship will move to drill Mahogany-2, the next appraisal well in Jubilee field.

"While appraisal of the upside of Jubilee is ongoing, the field partnership is also working on plans for a phased development of the field. The Eirik Raude fifth-generation semisubmersible has been contracted for a minimum of 3 years and is a critical element in our plan to target first oil in 2010," Tullow said.

Meanwhile, Tullow plans to redrill its Ngassa-1 high-angle well on Block 2 in Uganda from an alternative location. TD is 1,635 m.

The well cut 6 m of net gas bearing sands, and thick claystone seals provided good encouragement about underlying oil prospectivity. However, the primary and secondary oil objectives weren't reached due to persistent borehole instability.

Mariner starts gas field in Atwater Valley

Mariner Energy Inc., Houston, started gas production Feb. 15 from two-well Bass Lite field in the deepwater Gulf of Mexico.

The wells, in 6,750 ft of water on Atwater Valley Block 425, represent one of the gulf's deepest deepwater developments. Initial production of 60 MMcfd of biogenic gas flows via a 56-mile subsea tieback to the Devil's Tower spar on Mississippi Canyon Block 773.

Mariner, operator with 42.2% working interest, discovered the field in 2000 and estimated it will attain peak output of 125 MMcfd later in 2008. The initial rate is limited by the production system designed to achieve early production pending further topside upgrades. Eni SPA of Italy owns the other interest.

Mariner said Bass Lite "employs the second longest flowline for a subsea tieback and the longest umbilical utilizing fiber optics for primary control ever deployed in the Gulf of Mexico. Additionally, the steel catenary riser used to tie in to the Devil's Tower production facility appears to be the first designed and approved in accordance with the new MMS storm criteria for the Gulf of Mexico."

Continental touts Michigan TBR program

Continental Resources Inc., Enid, Okla., plans to drill five more wells in the second and third quarters in an Ordovician Trenton-Black River oil and gas play in Hillsdale County, Mich.

Continental said its McArthur 1-36 discovery well is flowing 260 b/d of oil and has been assigned gross proved reserves of 824,000 boe. A second well, Anspaugh 1-1, encountered similar type pay and is flow-testing 200 b/d.

A third well, Wessel 1-6, is flow-testing at rates as high as 100 bbl/hr during clean-up.

Continental has participated in two nonoperated TBR wells. Young 10-34 had encouraging shows and is awaiting completion, and Clark 1-36 is on test at low rates.

The company owns 29,200 net acres in the TBR play and has shot, processed, and interpreted 11 sq miles of 3D seismic. It plans to shoot 20 sq miles more in March and more later in 2008.

UK offers 2,297 blocks in licensing round

The UK government has launched its 25th licensing round where operators can bid for acreage in the North Sea. About 2,297 blocks will be available, and 72 blocks, originally classified as fallow, have been relinquished in time to be offered in this licensing round.

Alongside the traditional licenses, operators can apply for frontier licenses to develop difficult areas and promote licenses aimed at smaller companies to work up prospects.

Offshore trade association Oil & Gas UK welcomed the announcement, saying companies would ensure long-term development of the mature basin.

Malcolm Webb, Oil & Gas UK's chief executive, said, "Nearly a third of all exploration and appraisal drilling over the last year was on acreage that had passed through the 'fallow' and 'promote' initiatives, which highlights the benefits to be gained from government working closely with industry in encouraging maximum recovery of the UK's oil and gas reserves."

The deadline for applications is May 19. ✦

Drilling & Production — *Quick Takes*

Aramco lets contract for Tarzan-class rig

Saudi Aramco has let a 3-year drilling contract to Rowan Cos. Inc. for offshore work starting in the second quarter.

Bob Keller, a Tarzan-class jack up rig, is now en route to the Middle East. Rowan expects total revenues of $201 million from the contract, which has an option to be extended another year.

The contract expands Rowan's presence in the Middle East to nine jack ups, Chairman and Chief Executive Officer Danny McNease said. "Our Tarzan-class rigs, in particular, have demonstrated drilling capabilities that are well-suited to this environment, and all three of these rigs will soon be working offshore Saudi Arabia."

Africa Oil to use new rig for Puntland wells

Africa Oil Corp., Vancouver, BC, will use a new rig under contract from Energi Tata Persada Pte. Ltd. (ETP), Singapore, for its drilling program in the Puntland area of Somalia (OGJ, Sept. 3, 2007, p. 34).

ETP Rig. No. 3, under construction in the Shengli fabrication

yard in Dongying, China, is scheduled for delivery in mid-May. It's a 1,500-hp top-drive unit with three 1,600-hp pumps.

Africa Oil's day-rate contract covers two wells with a two-well option. Under a farmout from Range Resources Ltd., Perth, it will earn an 80% participating interest by drilling two wells each in the Puntland area's Nogal and Dharoor basins (OGJ, Mar. 26, 2007, p. 33).

It plans to spud the first Somali well in July.

ETP, a wholly owned subsidiary of Catur Khita Persada of Indonesia, owns four land rigs.

Neptune Marine to buy, reactivate semi

Neptune Marine Oil & Gas Ltd., Nicosia, has agreed to buy the Atlantic Venture semisubmersible drilling rig, former Sedco 708, and plans to reactivate it.

It signed a memorandum of agreement with Cypriot-based Zelie Industrial Ltd. to buy the rig, which was built in 1977, for $67 million. Transocean Inc. removed the Sedco 708 from its fleet in 2003.

Neptune Marine, a subsidiary of Jasper Investments Ltd., plans to refurbish the unit for work as a dynamically positioned semi able to drill to 25,000 ft in 5,000 ft of water.

The 345 ft by 245 ft vessel will have maximum displacement of 16,519 tonnes, displacement lightship of 9,307 tonnes, and variable load of 4,500 tonnes.

The agreement calls for Neptune Marine to take delivery of the semi in Cape Town, South Africa, by Apr. 7.

Previously, Neptune Marine acquired for upgrade two drillships, the Neptune Discoverer and Neptune Explorer (OGJ, May 8, 2006, p. 43).

US drilling activity dips

US drilling activity dipped lower during the week ending Feb. 22 with 1,771 rotary rigs working, 2 less than a week prior but up from 1,754 during the same period a year ago, said Baker Hughes Inc.

Land activity accounted for the loss, down 3 rigs to 1,694 units drilling. Inland water activity increased by 1 rig to 22 making hole. Offshore was unchanged at 55 rigs drilling, including 54 in the Gulf of Mexico.

In spite of the low net loss nationwide, Texas' weekly rig count fell by 9 to 866 drilling. Colorado was down 6 to 112. New Mexico declined by 2 rigs to 65. However, that was partly offset in Oklahoma where the rig count increased by 6 units to 201. Alaska was up 2 to 11, while Wyoming and California gained 1 rig each to respective counts of 74 and 33. Louisiana was unchanged with 144 rigs working. ✦

Processing — *Quick Takes*

Abu Dhabi to build 417,000 b/d refinery at Ruwais

Abu Dhabi will build a 417,000 b/d refinery, further boosting the emirate's existing 485,000 b/d refining capacity, reported the Emirates News Agency.

Quoting Jasem Ali Sayegh, general manager of Abu Dhabi Oil Refining Co. (Takreer), the agency said the facility will be completed by 2013. Sayegh was speaking at the Middle East Refining Conference in Abu Dhabi.

While still in the design phase, the new refinery will be built in Ruwais about 240 km from Abu Dhabi City, Sayegh was reported as saying. Abu Dhabi has two existing refineries: one at Ruwais with 400,000 b/d of refining capacity and a second at Um Al Nar with 85,000 b/d capacity.

An interrefinery pipeline will be built between the two Ruwais facilities, Sayegh said, "to eliminate the need for shipments as well as to connect Ruwais and Abu Dhabi."

Abu Dhabi's refining capabilities are run by Takreer, which took the responsibility of refining operations from Abu Dhabi National Oil Co.

Motor Oil (Hellas) expands Corinth refinery

Motor Oil (Hellas) Corinth SA, Maroussi, Greece, is expanding its 110,000 b/d refinery in Corinth about 70 km from Athens.

The company let contract to Technip for engineering, procurement, and construction management of a 60,000 b/d crude oil distillation unit to be operational early in 2010. It estimates the investment at €180 million.

The expansion follows an upgrade centered on the addition of a 37,000-b/d mild hydrocracker brought on stream in November 2005.

In that project Motor Oil also added a 32,000-b/d gas oil desulfurization unit and a 65,000-cu m/hr hydrogen production unit. ✦

Transportation — *Quick Takes*

Excelerate commissioning LNG port off Boston

Excelerate Energy LLC has begun commissioning its Northeast Gateway deepwater port in Massachusetts Bay.

The work, which includes testing of port equipment and systems, began after the Excelerate regasification vessel arrived on site.

The port employs Excelerate's Energy Bridge system for revaporizing LNG offshore and injecting it into a marine pipeline through a submerged turret loading buoy. The company is using the system at its Gulf Gateway deepwater port off Louisiana.

Northeast Gate, 18 miles east of Boston, will be able to handle peak deliveries of 800 MMcfd of gas through two turret buoys and under normal operations will deliver about 500 MMcfd (OGJ, June 4, 2007, Newsletter).

StatoilHydro ships first LNG cargo to US

StatoilHydro AS has delivered its first cargo of LNG from the Hammerfest liquefaction plant in Norway to Cove Point in the US.

The cargo arrived on Feb. 21 and marked the first export of European LNG to the US.

Cove Point is undergoing an expansion program and StatoilHydro has secured all of the new capacity. It will acquire 10 billion cu m/year of gas capacity from 2009.

Snohvit gas field is in the Norwegian Barents Sea. StatoilHydro will market a total of 4 billion cu m/year of gas at the field's full capacity.

Rune Bjørnson, StatoilHydro's executive vice president for the natural gas business area, said that he was confident that trading of LNG would become as flexible as oil–globalizing the market.

Snohvit field licencees are StatoilHydro (operator) 33.5%, Petoro 30%, Total E&P Norway 18.4%, Gaz de France 12%, Hess 3.3%, and RWE Dea Norway 2.8%.

PTT lets contract for Thailand's first LNG terminal

PTT PLC has awarded a $600 million contract to South Korea's GS Engineering & Construction Corp. to build Thailand's first LNG receiving terminal on the eastern coast.

Construction of the 5 million tonnes/year facility in Rayong, about 200 km southeast of Bangkok, is due to start shortly for completion in mid-2011, PTT said.

PTT, through subsidiary PTT LNG Co., plans to double the terminal's capacity to 10 million tpy in a later stage as it ramps up LNG purchases from several sources to meet the country's rising gas demand.

PTT recently signed an agreement to import 1 million tpy of LNG from Qatargas Operating Co. for 10 years starting in early 2011 with an option to increase the volume to 2 million tpy (OGJ, Feb 11, 2008, Newsletter).

PTT also has been in talks with other LNG suppliers in Indonesia, Australia, and the Middle East, as price disputes have bogged down the finalization of the 20-year supply of 3 million tpy from Iran's Pars LNG project.

US LNG imports in 2007 surpass 2006, review says

The US, listed as the world's fourth-largest LNG importer in 2007, received much more LNG last year than it did in 2006 and paid less for it, reported Pan EurAsian Enterprises Inc. in its yearend review of US LNG imports.

US LNG imports were 770.8 bcf, not including 26.3 bcf imported into Puerto Rico, vs. 583.5 bcf in 2006, and the year weighted average cost in 2007 was $6.66/MMbtu vs. $6.82/MMbtu in 2006.

This 15% increase was achieved because of an import surge during March-September 2007, which offset the falloff of activity during the fourth quarter of 2007 when LNG imports were 79.3 bcf vs. 134.7 bcf the same quarter in 2006, Pan EurAsian said.

BG remained the largest importer of LNG into the US at the Trunkline LNG terminal at Lake Charles, La., with a 54.7% market share in 2007. BG controls 100% of the capacity and throughput rights at Lake Charles, but does not own the terminal. Suez Energy NA was the second-largest importer, with 23.8% of the imports at its Everett terminal in Boston.

Pan EurAsian reported that overall average capacity utilization of the US LNG import terminals in 2007 was about 39.7%, according to the North American Terminal Survey (NATS) regasification data. However, the daily rate for capacity utilization varies widely around that number.

Overall LNG imports in countries of the Atlantic Basin (except Italy and Portugal, which are not covered) were up 15% over 2006. The US imported 17.1% of the Atlantic Basin volume (OGJ Online, Feb. 11, 2008). Spain remains the largest LNG importer in the Atlantic Basin with 44.5% of all the imports.

Trinidad and Tobago, with 58.5% of market share, remain the largest single country of origin for US LNG imports. Egypt and Nigeria were close seconds. However Trinidad and Tobago was the most costly source of supply. The least costly LNG came from Equatorial Guinea, a new entrant into the LNG supply picture in 2007.

A major component of the LNG business in 2007 was the more aggressive use of gas storage, and NATS calculates that storage played a major role in the surge of imports at Lake Charles during March-September.

The outlook for 2008 LNG imports is not thought to be as robust as it was in 2007, according to Pan EurAsian. The price profiles are not as supportive now as last year at this time, it said. Japan's need for LNG supplies to displace nuclear electricity generation capacity this year may keep LNG global prices far enough above US market prices to reduce the summer and storage replenishment surge that will occur.

TransCanada plans direct oil line to Gulf Coast

TransCanada Corp. said it is considering building an oil pipeline directly to the US Gulf Coast from Alberta's oil sands, press reports said Feb. 21.

An alternative would be to connect Alberta oil sands with Gulf Coast refineries by converting underused natural gas pipelines for part of the route, Chief Executive Officer Hal Kvisle was reported as saying.

Nearly half of total US refining capacity is on the Gulf Coast, but the lack of pipeline connections from Canada results in most Canadian oil sands exports' being sent to the US Midwest.

TransCanada and ConocoPhillips, in a 50-50 joint venture, already are planning the 590,000 b/d Keystone oil pipeline to the US Midwest from Alberta, and plan to extend Keystone to the Gulf Coast refining hub. The $5.2 billion Keystone line is expected to come into service in late 2009. TransCanada will convert existing gas pipelines in Canada to oil shipping for much of Keystone's Canadian section.

"But if the demand for transportation materializes more quickly, we would look at building a direct line," Kvisle was quoted as saying. "Either way, the discussions are well advanced, and this is one of the future projects that we will be bringing forward here in the months ahead."

The proposed pipeline would be competing with others planned by Enbridge Inc., ExxonMobil Corp., Kinder Morgan Canada, and Altex Energy Ltd., each of which is proposing an oil pipeline from Alberta to the Gulf Coast. ✦

Letters

Uninvited observations

I understand that the Association for the Study of Peak Oil & Gas (ASPO) will not always be invited to speak at CERA Week (Cambridge Energy Research Associates annual conference in Houston), but if I had been invited I could have discussed the CERA 2006 forecast of future oil production (Journal of Petroleum Technology, February 2007). CERA's prediction is divided into conventional and unconventional oil, and if we sum the CERA-predicted crude oil consumption to 2070 we get a number in the region of 2,000 billion bbl, twice as much as has been consumed to date. Production of 70 million b/d in 2070 requires reserves of the order of 500 billion bbl, and current crude oil reserves are 800 billion bbl. Adding the numbers, 500 billion bbl plus 2,000 billion bbl, less 800 billion bbl, we arrive at a figure of 1,700 billion bbl. This is the amount of oil that must be found and developed during the next 62 years, or 27 billion bbl/year. For these figures to work the oil industry needs to get out and start looking for oil like crazy.

If we just look 3 years ahead to the end of 2010, CERA perceives that crude oil production is set to be 80.8 million b/d. This is an increase of 8 million b/d when compared with today's production. In 2002 ExxonMobil presented a fantastic graph in their magazine The Lamp. They showed that the decline in existing oil and gas fields was expected to be 4-6%/year for the next 20 years. Last year CERA presented a detailed study of the decline in existing oil fields based on a study of 811 fields, and that gave an average decline rate 4.5%/year. We at Uppsala Hydrocarbon Depletion Study Group have made a study of decline in giant oil fields using data from 333 fields, representing 60% of global oil production, and CERA's stated decline for large fields is of the same order as our figure for decline. For argument's sake, let us use the CERA number for the rest of our discussion.

CERA's decline rate for 2008, 2009, and 2010 means that the industry needs to fill a gap of 10 million b/d by the end of 2010. If we then add the increase in

production of 8 million b/d that CERA predicts, we find that the world requires new production in the order of 18 million b/d in just 3 years. Is this really possible?

First we have to turn to Saudi Arabia and Saudi Aramco as they have the largest reserves. According to a seminar given in Washington in 2004, they have 700 billion bbl in place, and the cumulative production for Saudi Arabia to date is 119 billion bbl. Out of the reported 260 billion bbl of reserves they reported in 2004, they labeled 131 billion bbl as developed, and the depletion rate of developed production was 2.7%/year. A realistic assumption is that the depletion rate should be no higher the 3% in 2010. The fact that Aramco claims to have 700 billion bbl in ground, have produced 119 billion bbl, and have 260 billion bbl in reserves gives a recovery factor of 54%.

Saudi Aramco Chief Executive Officer Abdallah Jum'ah was invited to CERA 2008 and said that new investment is expected to boost the company's oil production capacity to 12 million b/d by the end of 2009. With a depletion factor of 3%, this means that Aramco must increase their developed reserves from 131 billion bbl in 2004 to 146 billion bbl in 2010. In 1998 Aramco added the Shaybah field and 500,000 b/d. Aramco's promises amount to new production equal to four Shaybahs and still require compensation for the decline of other fields.

Adding the new Saudi oil to the expected increase of production in new deepwater projects of around 4 million b/d plus other new projects providing an additional 2 million b/d, we end up with a figure of 8 million b/d of the 18 million b/d needed. We still have to find 10 million b/d to fill the gap in the CERA forecast.

If invited I would have covered many other interesting aspects of future oil production, but now I would just like to agree with the invited speaker John B. Hess, chairman and chief executive of Hess Corp.: "Given the long lead times of at least 5-10 years from discovery to production, an oil crisis is coming and sooner than most people think. Unfortunately, we are behaving in ways that suggest we do not know there is a serious problem (OGJ Online, Feb. 15, 2008)."

Kjell Aleklett
President, ASPO
Professor, Uppsala University
Uppsala Hydrocarbon Depletion Study Group
Uppsala, Sweden

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Oil sands and sustainability

Paula Dittrick
Senior Staff Writer

Canada's oil sands projects sometimes are portrayed as looming environmental villains. Much of the mainstream media are missing the likelihood that oil sands producers could prove to be leaders in advancing carbon capture and sequestration (CCS) technology.

Oil companies are involved in carbon capture research as part of diverse efforts to curb greenhouse gas (GHG) emissions that can contribute to climate change.

Industry alliances aim to help finance and organize large-scale CCS pilots. Enbridge Inc. plans to lead a group of 19 oil companies and electric utilities in the Alberta Saline Aquifer Project, which will identify potential storage formations and later design sequestration sites (OGJ, Feb. 11, 2008, Newsletter).

Saskatchewan officials tell OGJ that a similar alliance is in the planning stages there.

Integrated CO_2 Network (ICO_2N) was formed in late 2007 to develop an Alberta carbon capture network and pipeline. Members include Canadian Natural Resources Ltd., ConocoPhillips, Husky Energy Inc., Imperial Oil Ltd., Nexen Inc., Shell Canada Ltd., Syncrude Canada Ltd., and Suncor Energy Inc.

Suncor's goal

ICO_2N founding member Suncor voluntarily reports its GHG emissions as part of a 10-year-old climate action plan, which Suncor calls key to "becoming a sustainable energy company."

The Calgary firm's 2007 Progress Report on Climate Change reports a 26% companywide reduction in GHG emission intensity (emissions per bbl of oil) from 1990 baseline levels. For Suncor's oil sands operations alone, emission intensity has fallen 51% since 1990.

Richard L. George, Suncor president and chief executive officer, believes climate change requires determined and collective action. "The energy industry has a particular responsibility—and opportunity—to respond," he said.

Suncor calculates that management of its GHG emissions prevented 53.1 million tonnes of CO_2 from entering the atmosphere through yearend 2006 compared with the 1990 baseline.

Every quarter, Suncor's senior management team reviews company GHG emissions statistics.

Suncor aggressively pursues technologies, including CCS, to transform its GHG emissions profile, George said. This includes improved energy efficiency and reduced reliance on natural gas.

"Technologies such as petroleum coke gasification could further reduce our reliance on natural gas," said the company's latest climate change report, which acknowledges "a new era of GHG regulation.

"In particular, we are encouraged by plans to establish funds that large emitters such as Suncor can contribute for development of transformative technologies," the company said.

On Feb. 1, a joint federal-provincial government panel recommended that Canadian governments invest $2 billion (Can.), to be matched by industry funding, toward CCS research. The initial goal is to sequester 5 million tonnes/year of CO_2 by 2015 (OGJ, Feb. 11, 2008, p. 21).

As part of OGJ's health, safety, and environment coverage, this reporter will watch closely to see how industry might transfer lessons from Alberta's oil sands to oil and gas fields worldwide.

GHG contributors

Oil sands promise a steady, reliable source of energy for decades that will supplement conventional oil and gas reserves.

Currently, the oil sands industry accounts for less than 3% of Canada's total annual GHG emissions. Suncor's operations accounted for 1.3% of Canada's total GHG emissions during 2005, the company reported.

New technology is being tested that could reduce GHG emissions from oil sands extraction facilities.

Suncor believes the integration of electric power utilities and heat systems could lower GHG emissions compared with current technologies.

Geothermal energy is being considered as a low-emissions alternative to gas, currently used to provide heat and steam for oil sands extraction.

Water could be pumped several kilometers below ground where it absorbs heat from hot rock. Then, the water would be returned to the surface where the heat could be extracted and used to produce steam.

This OGJ writer looks forward to reporting oil sands producers' progress toward safe, cost-effective, and long-term carbon mitigation, management, and storage. In short, this is what Suncor's chief executive calls industry's responsibility to sustainability.

"We know a significant portion of GHG emissions from each barrel of oil comes from its production. However, approximately four times more GHGs are emitted once it is used as a fuel," George said. "That means there are clear opportunities to make substantial sustained GHG reductions both when oil is made and used." ✦

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Editorial

The surges in Iraq

Thanks to success of the surge dominating news from Iraq, the time approaches to reconsider another surge now largely forgotten. The fates of both surges are linked. The forgotten one relates to oil production.

Fear once was widespread that Iraqi oil would gush into the market and crush prices after the fall of President Saddam Hussein. It was groundless. Even before the war, the need for repair and modernization of the Iraqi producing industry was obvious; postwar examination of Iraq's decrepit oil fields showed it to be greater than originally thought. A surge in Iraqi oil production was never going to come about quickly enough to reverse a tightening of the oil market under way when the invasion of Iraq began.

Security need

Because the invasion gave way to the bloody mire of counterinsurgency that continues even now, work to raise Iraq's production capacity became wholly contingent on security. To the global public and parts of the oil industry, therefore, prospects for a surge of Iraqi oil have slipped from mind. That the Iraqi industry has been able to keep average production near 2 million b/d despite countless attacks and to push recent output close to capacity of 2.5 million b/d is, in fact, heroic.

But security is improving because the military surge is working, nay-saying by opponents of the Bush administration notwithstanding. That surge gets its name from a force build-up and strategy adjustment implemented early last year. After an early burst of retaliation, Iraq's plague of violence, while not ceasing, is losing its virulence.

Washington Post columnist Charles Krauthammer recently catalogued other reasons for hope: signs of reconciliation between Sunni and Shiite groups, including in incendiary Anbar Province; normalcy in much of Baghdad; vanishing support for the insurgency; "despair" expressed in captured letters of al-Qaeda leaders; and passage by the Iraqi parliament of laws defining provincial powers, granting partial amnesty to mostly-Sunni prisoners, and approving a national budget that allocates revenue among provinces. Though still far from total success, this is progress.

The improvement makes questions about a potential surge in Iraqi oil output reasonable to ponder. By how much might the country raise production? When and under what circumstances might the increase occur?

Iraq has an estimated 115 billion bbl of underdeveloped oil reserves, and some observers think the number might eventually reach 200 billion bbl. So a longstanding production target of 6 million b/d is geologically feasible, though not quickly achievable. In much less time the country could push production capacity to 3.5 million b/d.

Timing for either goal, though, remains uncertain. While the requisite security is coming into view, the terms under which foreign companies might invest in Iraqi production projects are not.

Iraq has discussed but not enacted a hydrocarbon law. Complicating the politics of that effort is the Kurdistan Regional Government's preemptive opening of exploration and production in territory it governs in the north. After enacting its own hydrocarbon law, the KRG signed several contracts with foreign oil companies, which are providing early evidence that estimates of Iraq's exploratory potential haven't been overstated.

The autonomous welcome to international oil companies has put the KRG in conflict with the Iraqi government and, some say, delayed progress on the federal hydrocarbon law. Apparently responding to the pressure, the federal oil ministry last month conducted a registration exercise for companies interested in future licensing rounds, whatever the terms might be (OGJ, Jan. 21, 2008, p. 38). Here, too, is progress shy of success.

A third surge

While Shiite, Sunni, and Kurdish factionalism complicates the jurisdictional dispute, the market is giving Iraq another important surge: in revenue from oil exports. A US government report says elevated oil prices might net the country an extra $19.2 billion this year (OGJ, Feb. 11, 2008, p. 32).

The money can help speed reconstruction, improve Iraqi living conditions, and keep the country on course toward stabilization. That there would be even more money if Iraq produced more oil should be all the encouragement Iraqi officials need to settle differences and promptly pass a hydrocarbon law. ✦

Oil industry has new risk factor: terrorism

David M. Weinberg
Practical Risk LLC
Albuquerque, NM

Glenn H. Coplon
Independent research analyst
Falls Church, Va.

Jack F. Williams
Georgia State University College of Law
Atlanta

Although the oil and gas industry has always encountered elements of risk, traditional risk meant dry holes, foreign investments, unstable nation states, new ventures, and the occasional natural hazard. Man-made catastrophic events were not part of the risk profile and merited little attention beyond risks associated with insider sabotage or vandalism. The terrorist attacks of Sept. 11, 2001, in New York and Washington, DC, changed that environment dramatically and added sharp new focus to the industry's approach to risk.

For reasons ranging from legal to fiduciary, quantifying and systematically analyzing this newly recognized risk have become increasingly important to an industry with physical assets around the world. Unfortunately, typical techniques and analytic approaches used by businesses to consider a proper business case for risk have proven difficult to apply in this new environment.

For operators, including terrorism risk seems daunting. The nature of the risk complicates its analysis. Companies may find it difficult to confront this new environment of adaptive and thinking adversaries and scarce relevant data and incorporate it into the context of risk management.

However, the industry can sharpen its approach to this important area by understanding definitions and quantitative techniques evolving in antiterrorism work. This article suggests ways to estimate and manage terrorism risk in oil and gas operations.

Lack of data

Quantification of this "new" type of risk has become increasingly important, but terrorism risk computations suffer from a lack of relevant statistical data. One cannot use classical probabilistic risk assessment tools such as those used in accident analyses where vast databases of component failures exist to enable rigorous models to be constructed.

At first glance, it appears there is ample statistical data to employ classic probabilistic models. For example, Rand Corp. has more than 30,000 terrorist actions around the world in its database. The Memorial Institute for the Prevention of Terrorism includes over 34,000 terrorist actions committed since 1968 (Fig. 1).[1] And the National Consortium for the Study of Terrorism and Responses to Terrorism includes over 80,000 terrorist actions since 1970.[2] Even with what appears to be these impressive databases of terrorism events, Rand acknowledges that "the lack of historical data makes the use of experts the only way for modelers to determine the likelihood of new attacks."[3]

There are a number of problems, pitfalls, and deficiencies associated with these databases. For example, a quick read of reported terrorist events exposes the difficulty of separating terrorist acts from criminal acts. Such fundamental problems of definition, the variety of terrorist organizations and motives, and the adaptability of terrorist methods and tactics make looking backward problematic in predicting future events. Data insufficiency poses problems for actuarial firms that provide risk models for the insurance underwriting industry, primarily because their contemporary best practices are based, in large part, on statistical approaches.[4]

Dating to 1977 is an exemplar discussion of some problems associated with risk related to such rare events within the energy industry as an attack on LNG facilities.[5] In looking at terrorist attacks as both extreme and catastrophic events, Y.Y. Haimes says, "...no single probability density function…can be assigned to represent credible knowledge of the likelihood of such [terrorist] attack scenarios."[6]

Definition of terms

Much confusion surrounding the topic of terrorism risk stems from the lack of consistent definitions of terms. The Security Analysis & Risk Management Association is attempting to standardize various terms in a lexicon that may or may not be adopted.[7] Occasionally, the US Department of

Homeland Security (DHS) publicizes glossaries, but these tend to be adapted to fit a particular topic and often are inconsistent with other DHS publications. Developing a working glossary is clearly a project in itself and is beyond the scope of this article; thus, the terms used here will rely on common usage or will be defined within the context of this discussion.

Consistent with traditional literature on risk, DHS identifies three components:

- Threat.
- Vulnerability.
- Consequence.

To capture the statistical nature of risk, the risk function classically is represented as the product of the probability and results of a particular outcome. However, as noted by many authors, using probabilities based on prior history for dealing with adversaries, e.g., Al Qaeda, Hezbollah, or even the Earth Liberation Front, is limited by their ability to be adaptive and creative in devising new attacks. The adaptability of terrorists in varying tactics, target sets, diversions, and simultaneity compound the problem. Further, statistical probability implies that all possible outcomes are known. Such is certainly not the case with terrorist attacks.

With these limitations in mind, DHS created a surrogate for probability. This surrogate comprises threat and vulnerability. Along with consequence, this becomes a type of conditional risk that is a function of many other variables, only a few of which can be addressed here.

The US Department of Defense (DOD) identifies threat as an adversary having intent, capability, or opportunity to cause loss or damage.[7] However, recent work by J.F. Williams indicates that, with respect to radical Islamic terrorism, there is a third component to threat space—authority.[8] This additional threat element has both an internal and external function.

Internal authority is necessary in order for a terrorist organization to sustain its activity on a global level, to maintain membership and support, and to provide religious cover to terror agents whose actions are viewed as sacramental duties rather than acts of violence.

External authority, better understood as legitimacy, is necessary to attract recruits and supporters, to convince the group's audience of the legitimacy and acceptability of target and attack modes, and to justify the magnitude of the attack. In fact, Williams' concept can probably be expanded to nearly any terrorist organization because, save for the lone wolf, someone must decide and commit to carrying out the attack in some form of cultural threat space.

National security considerations are not conducive to information-sharing with the oil and gas (or any private) industry. Only recently has DHS been able to participate with fusion centers in various states, but most personnel manning these sites deal in classified intelligence information, which is fed as appropriate to local law enforcement and national authorities. Gleaning the intent, capability, and authority of any given threat stream from such rare and necessarily nonspecific unclassified reports can be nearly impossible. However, some sources of unclassified information —open source intelligence—can help operators develop profiles of possible threats in their areas of operation.

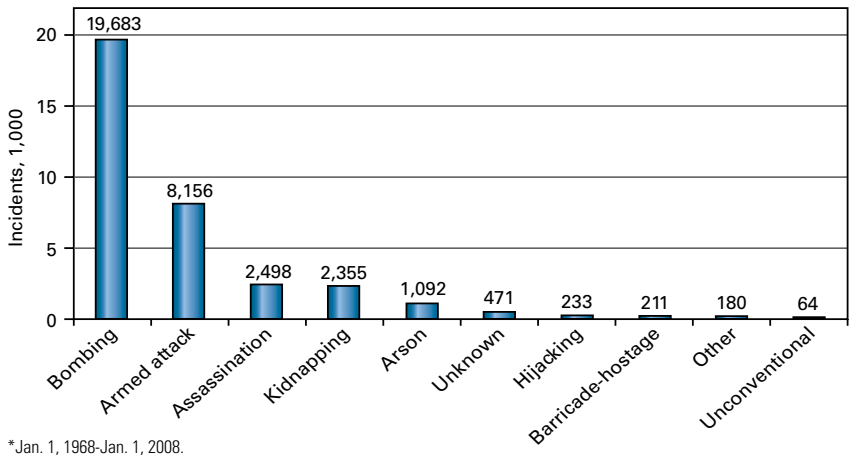
If intent, capability, and authority are known, the precise means, often referred to as attack mode, may represent a critical independent variable in an overall estimation of threat. For instance, Al Qaeda professes that it would use weapons of mass destruction (WMD) against the US. While having the intent and religious authority to do so, however, at present it appears that it does not have the capability. Conversely, the use of improvised explosive devices (IEDs) of varying sizes is a well-used tactic, but their effect is less than that of WMD.

Even if information were available to estimate the likelihood of a given type of terrorist attack such as an IED or vehicle-vessel borne IEDs (VBIED), questions remain as to selection of the most cost-effective array of countermeasures. This is because details necessary to fully determine the likely delivery "character" of an attack are seldom discussed. For example, what is the blast area of a given IED charge in the target area? Or what is the likely delivery mode of a VBIED: a lone panel truck? a convoy with sniper preparatory fire to pin down facility security personnel?

In many instances, such information is available, or could be, but doesn't seem to be considered newsworthy. As a result, even facility owners determined

WORLDWIDE TERRORISM INCIDENTS*

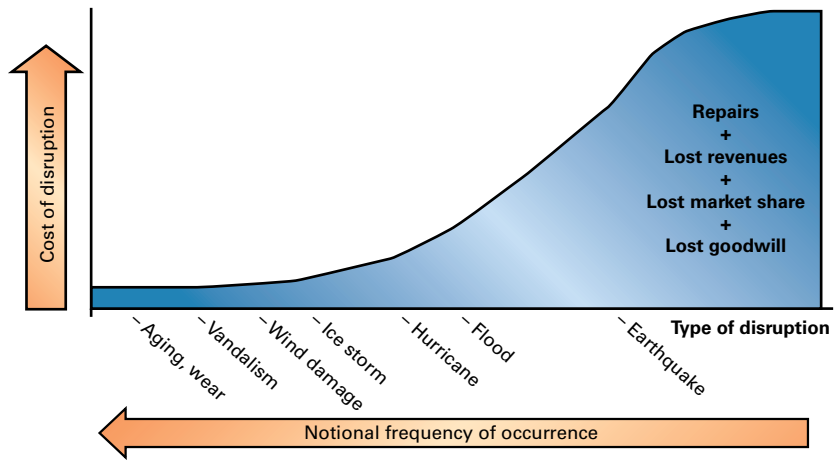
Fig. 1



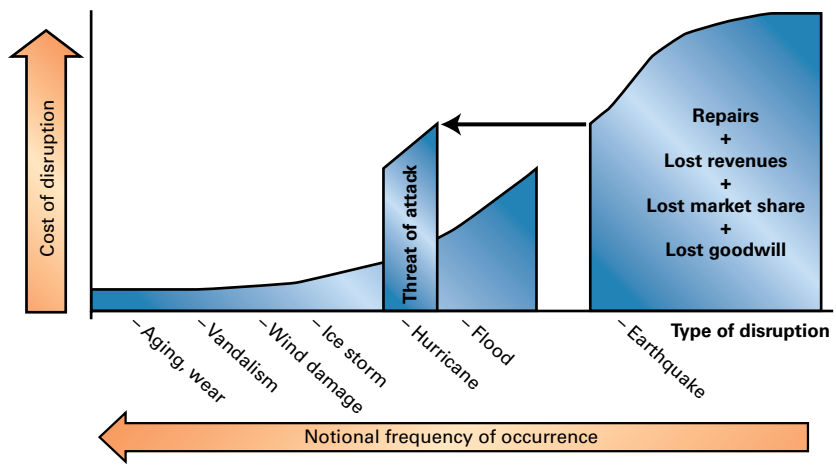
*Jan. 1, 1968-Jan. 1, 2008.
Source: Data from Memorial Institute for the Prevention of Terrorism

TERRORISM THREAT'S AFFECT ON COMPANY RISK PROFILE

Company risk profile Fig. 2a



Threat of attack raises costs disproportionately Fig. 2b



to take action are left to wonder which specific countermeasures to choose.

Although there is no assurance that available attack characteristics will define a future attack, there is merit in using them when considering countermeasures. As a general proposition, terrorists tend to develop an approach that works and then stick to it; in fact, they train on it. Constructing IEDs is often tricky work, and those who can often build and provide a steady supply for delivery; their techniques are taught in training camps.

Delivery tactics, on the other hand, are more often adaptive and tend to remain unchanged until countermeasures used against them force it. Following the evolution of both bomb-making and delivery techniques can provide useful tools when considering cost-effective countermeasures.

Vulnerabilities of any given physical or cyber asset are often uncovered during safety and security analyses. Making assessment an even greater challenge, recent work regarding hurricane damage to offshore platforms suggests that vulnerability to damage is asset-specific as well as attack specific.[9 10] Quantifying vulnerability is tedious work and remains something of an art form.[11 12 13] Methodologies such as DOD's criticality, accessibility, recuperability, vulnerability, effect, and recognizability (CARVER) have been found to be of limited value when comparing vulnerabilities across a spectrum of assets in various geographies.[14]

In business, consequences of a terrorist attack are usually measured in dollars and casualties, which can be converted to dollars. Other aspects such as capacity to perform mission or psychological impacts cannot easily be quantified, though these can and do impact continuity of operations, and therefore profitability. How companies approach potential losses is reasonably well established if the loss is part of an understood threat. Hurricanes do not learn from previous storms, nor do they target specific assets to maximize destruction. Unfortunately, the same cannot be said of terrorists, the one class of threat agent that learns and adapts to developments.

Security as a cost

In some ways security is similar to other costs of doing business such as sales, administration, maintenance, and environmental and regulatory compliance. It competes against other expenditures, and tradeoffs are made in the corporate interest. But in other ways, security is very different. Maintenance problems do not learn, nor are they deterred. Regulations generally do not focus solely on single facilities within a complex so only maximum disruption is prevented.

Security costs, like the others mentioned, should be considered in a cost-benefit analysis and factored in like any other sunken cost as a normal cost of doing business. Performing such an analysis of terrorist attacks, however, is problematic because at whatever scale (unit, site, region, state, country, worldwide), assets prioritization is required. This implies that quantification of risk—and, as importantly, quantification of countermeasures and response capabilities—is necessary. In other words, risk management should be quantified as much as possible if dependable estimates of cost-benefit ratios

and security investment prioritizations are to be made.

Insurance underwriters strongly support the Terrorist Risk Insurance Act of 2002 (reauthorized in 2005 and 2007) because it limits their exposure to claims in the event of a terrorist attack having significant losses.[15] The Mortgage Bankers Association notes: "As real estate capital markets continue to weather industry turmoil, extending terrorism risk insurance will resolve an important area of capital market uncertainly [sic]—the long-term availability of terrorism insurance."[16] Self-insured oil and gas operators may run significant risks if terrorist attacks are not included in their risk profile. Fig. 2a shows a notional risk profile for a company regarding typical interruption events, and Fig. 2b illustrates how a risk profile can change when an imminent threat is identified.

Because quantification of terrorism risk is not especially amenable to conventional probabilistic tools, prioritization of security investments and insurance coverage are also uncertain. However, some inroads to this challenge are being made.

Risk computation

Within the terrorism risk community—a discipline essentially born on 9/11—there is debate about what are the proper mathematical operations that relate to the variables of threat, vulnerability, and consequence.

One can argue that if any of the values that make up terrorism risk is zero, the risk is either nonexistent or of little concern. That is, if a particular asset is perfectly invulnerable, regardless of how valuable it may be, how many people want to destroy it, or how many threats against it have been documented, its risk is of no real concern. Implicitly, this statement converts to a simple formula of risk being the product of threat, vulnerability, and consequence.

While it is improbable that any of the threat, vulnerability, or consequence variables truly would be zero, some attacks can realistically be taken out of consideration either because their consequences are so low as to be insignificant or because the attack is of such enormous magnitude (i.e., a nuclear attack) as to make preparations essentially impossible or irrelevant, at least within the realm of the private sector.

It is unlikely that many operators have built and maintain databases that have even a small fraction of all the data required for making such a calculation even for a single asset, much less for a site, region, or global portfolio of assets.

Some challenges

The 9/11 Commission Report and other writings have documented a number of intelligence community failures to "connect the dots" prior to the 9/11 attacks.[17,18] While federal intelligence groups seek to improve their methods in this regard, the missions of the various agencies and their previously embedded culture of secrecy suggest it may be some time before such improvements are realized.[19]

While there is a need for secrecy of classified information, a robust open source intelligence process may well provide sufficient information to perform risk assessments. Intelligence gathering has long been performed by the private sector, and carefully focusing some of that capability towards potential terrorist threats within areas of concern may serve operators well. However threat information may remain the most uncertain of the data needed for quantitative terrorist risk assessments, in large part because threat information, unlike vulnerability and consequence information, is solidly within the hands of the adversary.[20]

The problem of uncertainty is not only manifested in threat. Typically, there also are more than one asset type in any given geographic area. "Critical infrastructure is often geographically concentrated, so it may be distinctly vulnerable to events like natural disasters, epidemics, and certain kinds of terrorist attacks," said P. Parfomak in a report of the Congressional Research Service. "Additionally, disruption of concentrated infrastructure could have greatly disproportionate effects, with costs potentially running into billions of dollars and spreading far beyond the immediate area of disturbance."[21]

Risks to all assets of one type within an area are not identical. For instance, assuming that threat and vulnerability values were equal, the risk from attacks to petrochemical plants along the Houston Ship Channel could differ greatly because the potential consequence to human health will vary by individual specific asset. A truly comprehensive risk assessment would sum the risk of all possible combinations of threat, vulnerability, consequence, and attack mode—clearly an overwhelming task.

Other considerations include both spatial and functional interdependencies. Spatial interdependency is the collocation of two infrastructures, a common example being telecommunication lines "hosted" by vehicular bridges. There is no relation between the two other than their location at the same place on the ground. Should an attack occur that involves, say, explosives, both infrastructures could be affected, regardless of the intent of the perpetrator. Functional interdependencies are too often illustrated by cascading failures such as happened in the 2003 Northeast blackout.

Another major parameter baffling risk analysts is how to measure risk reduction from implementing various types of protective or countermeasures or increasing response capabilities. With the possible exception of nuclear material facilities, workers in the field have been largely unable to quantify the value of countermeasures or capabilities across the risk spectrum and have therefore been unable to measure risk reduction—the defining and singularly important task in the overall risk management. This problem further plagues our ability to justify investments in a conventional cost-benefit sense.

Ranking assets

From an operator's standpoint, the issue of terrorism risk can be addressed

using an approach as described above tuned to specific circumstances. The accuracy and precision of "risk numbers" must be considered as highly uncertain but perhaps no more so than new exploration ventures.

Like other investments, the risk prioritization approach will provide a relative ranking. Getting started is usually the biggest hurdle because it seems overwhelming. However, close collaboration within a company's security, finance, human resources and other departments and among companies within a particular region will better prepare everyone for potential losses.

With no statistically valid basis for estimating a probability of attack, we are unable to defend a classical cost-benefit approach.

However, some method must be used to rank or prioritize assets, if only locally, to ensure prudent security investments. Consider the following along with standard continuity of operations planning:

- What attack types concern me most?
- Who are the potential perpetrators, and what is driving them? It may help to adopt an "observed or worst-case terrorist tactic" approach, with different tactics for each entity (asset-site-region-operator-country-portfolio).

Close cooperation between, and acceptance by, each faction of the company is necessary to maximize risk management, including threat identification and vulnerability and consequence mitigation.

While quantification of risk can be difficult, the discipline of working through it for the company's most important assets is essential to long-term security.

Risk is ubiquitous. For this industry, avoiding it is not a luxury. Although risk assessment as a tool of understanding and managing risk through remediation or loss-transference is as much an art as it is a science, operators should not ignore the science dimension. Present private sector risk models assessing terrorism threats are incomplete, undisciplined, and problematic. By embracing a more robust approach to risk through the aggressive management of risk's components, a company may begin to understand, respond to, and manage its own threat and risk profile.

Until then, companies in an industry that terrorist groups have identified as a high-value target will maintain inadequate security programs where the absence of an attack is mistaken for an effective antiterrorism security program. ✦

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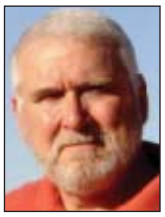

David M. Weinberg (dave@practical-risk.com) is president and CEO of Practical Risk LLC, a terrorism risk analysis consulting firm. His work is an outgrowth of his previous risk analyses at the Department of Homeland Security's Office of Infrastructure Protection, where he developed methods for allocating Homeland Security grant funds. Weinberg began work in the petroleum industry with Cities Service Oil Co. in 1970. After receiving his PhD from Texas A&M University in 1977, he spent more than 17 years with Conoco in upstream and research and development positions followed by 12 years with the Idaho National Laboratory. Weinberg is a member of American Association of Petroleum Geologists, Society of Exploration Geophysicists, Society of Petroleum Engineers, and the Society for Risk Analysis.

Glenn H. Coplon (glenn.coplon@lionharte.com) is an independent operations research analyst in Falls Church, Va., doing contract work in both threat and risk analysis for the Department of Homeland Security. He previously was a longtime employee in the Department of Energy's Office of Energy Emergencies. Coplon holds a BS (1956) in mathematics from Virginia Tech and has done graduate work in economics at both Virginia Tech and George Mason University.

Jack Williams, JD, CIRA, CDBV (jwilliams@gsu.edu) is a professor of law at Georgia State University College of Law in Atlanta and the scholar in residence at the American Bankruptcy Institute in Alexandria, Va., where he is researching risk in the energy industry, among other topics. He serves as a consultant to the federal government and the private sector on threat analysis, risk assessment, infrastructure protection, counterterrorism, and Jihadist theory and tactics. He has addressed the American Petroleum Institute's annual meeting, security professionals within API, the National Petrochemical & Refiners Association, the American Chemistry Council, and American Society for Information Science. Williams is a member of the American Bar Association, the Coast Guard Auxiliary, the Federalist Society, and the American Statistical Association and is a fellow in the American College of Bankruptcy. Williams also is a director in BDO Consulting, where he serves as a financial advisor, forensic accountant, and financial fraud detection expert. Williams has authored four books and over 100 articles and papers.

Bush sending mixed signals about SPR, alternate fuels

Nick Snow
Washington Editor

The administration of President George W. Bush sends conflicting signals when it wants to expand purchases for the Strategic Petroleum Reserve despite unusually high prices while vigorously promoting alternatives to end the nation's "oil addiction," Democrats on the Senate Energy and Natural Resources Committee charged.

"There's a carnival of speculation in the markets. Prices for both crude oil and gasoline are bouncing around at high levels, yet we're taking oil off the market and into the ground," said Sen. Byron L. Dorgan (D-ND) during the committee's Feb. 26 hearing on US oil inventory policies and the SPR.

A US Department of Energy official testified that expanding the reserve is required under the 2005 Energy Policy Act, that it's part of a comprehensive national energy policy, and that the purchases are so small relative to the total global oil market that they don't have a noteworthy impact. Some Republicans on the committee suggested that continued fill is prudent given many overseas suppliers' uncertain political situations.

Katharine Fredriksen, principal deputy assistant secretary in DOE's policy and international affairs office, said the Bush administration's objectives for the SPR are to achieve 727 million bbl in storage in 2009, 1 billion bbl in 2019 and 1.5 billion bbl in 2029. "Expansion of the SPR is essential to meeting the nation's future energy needs," she said.

Currently, SPR supplies roughly equal 58 days of domestic demand. Higher SPR inventories are necessary because domestic demand and imports have increased, Fredriksen said. The reserve achieved its originally mandated goal of 90 days of import protection in 1983 and reached 118 days' supply in 1985 before Congress discontinued funding to buy oil and purchases were suspended in 1994, she said.

"The amount currently being placed in the SPR of 70,000 b/d of royalty-in-kind oil is less than one tenth of one percent of the daily global demand of 85 million b/d and is well within producers' existing excess production capacity. The modest fill rate does not put undue pressure on markets," Fredriksen said.

Strategy questioned

Frank A. Verrastro, director and senior fellow of the Energy and National Security Program at the Center for Strategic and International Studies, said, "I understand [that] arithmetic. The question is the philosophy of taking oil off the market at all when prices are so high and both President Bush and Energy Secretary [Samuel W.] Bodman have asked Middle East members of the Organization of Petroleum Exporting Countries to produce more so prices will come down," he said.

Sen. John Barrasso (R-Wyo.) also questioned the strategy. "The main question is whether taxpayers are getting the most for their money. It seems to me that continuing to buy oil at these high prices means that we either expect prices to go up more or we perceive a threat," he said.

Melanie A. Kenderline, a former DOE policy office director and current associate director of the MIT Energy Ini-

WATCHING GOVERNMENT

Nick Snow, Washington Editor

Governors push alternative energy

Oil and gas were pushed to the sidelines during the National Governors Association's 2008 winter meeting in Washington, DC. But a few states' chief executives acknowledged that traditional energy sources will have to come off the bench to meet energy and environmental challenges.

Tim Pawlenty, Minnesota's Republican governor and NGA's 2007-08 chairman, unveiled a year-long initiative, "Securing a Clean Energy Future," with goals similar to those of Congress and the Bush administration: reducing US dependence on imported oil and cutting greenhouse gas emissions by developing more environmentally benign, domestically produced alternatives.

SCEF would use states' positions as utility regulators and their universities to advance research into energy alternatives and create financial incentives for their development. Governors and outside speakers emphasized that business can't continue as usual.

'Can fill the gap'

But other governors warned that traditional energy sources should not be marginalized in the drive for alternatives. "Natural gas, being clean-burning, should be included in a greener energy future," observed Alaska Gov. Sarah Palin, a Republican who is the NGA Natural Resources Committee's vice-chair, as its meeting began on Feb. 24. "The conventional resources we have can fill the gap between now and when new technologies become economically competitive and don't require subsidies."

Edward M. Kelly, a midstream gas specialist at Wood Mackenzie Ltd. in Houston, told the committee that the country faces energy inevitabilities including continued US reliance on imported oil, domestic oil and gas production remaining vital with more reliance on unconventional sources, and increased use of gas instead of coal to generate electricity.

But Wyoming Gov. Dave Freudenthal, a Republican, warned that using more gas to generate power won't totally solve the greenhouse gas emissions problem. "It's troubling because it can lead to production from deeper formations, which could include as much carbon dioxide as from coal and which should include the same restrictions," he said.

'Problems can come up'

Following the meeting, he told me that ExxonMobil Corp.'s production from deep gas formations at Short Creek vents 2 Mcf of CO_2 for every 1 Mcf of methane that is recovered. "They're using some of it for enhanced recovery, but problems still can come up with deep gas. All natural gas is not the same in terms of carbon emissions impacts," Freudenthal said.

Colorado Gov. Bill Ritter, a Democrat, suggested that roles for oil, gas, and coal might need to be addressed later.

Palin said Ritter might be right. "I just don't want things to get out of hand with incentives for renewables, particularly since they imply subsidies, while ignoring the fuels we already have on hand," she told me.

Convincing other US governors that oil and gas still have an important place in the national energy future will take time, Palin said. "It's a different ballgame with this group than in Alaska. We're in the minority here." ✦

tiative, said the money could be better spent on energy efficiency programs, where spending has plummeted in recent years.

Other alternatives

Frank Rusco, acting director for natural resources and environment at the Government Accountability Office, told the committee GAO recommends purchasing more heavy crude, which would both save money and provide standby supplies for refineries configured to run more sour grades.

DOE should also consider using dollar values instead of barrels in filling the reserve because it would let it buy more oil when prices are low, he indicated. "GAO found that if DOE had used this purchasing approach from October 2001 through August 2005, it would have saved approximately $590 million, or over 10%, in fill costs. GAO's simulations indicate that DOE could save money using this approach for future SPR fills, regardless of whether oil prices are trending up or down as long as there is price volatility," Rusco said.

Fredriksen countered that DOE plans to buy some heavier grades as it expands the reserve. It currently buys light and medium crude because they reflected the US refinery configuration when the program began. The 11 US refineries that are configured to process sour crude would still be able to refine a limited amount of SPR crude and maintain their full gasoline production, she added.

Committee chairman Jeff Bingaman (D-NM) said he convened the hearing because SPR policies had been inconsistent not only across administrations, but also sometimes during a single administration. "We also need to discuss whether we should be adding more crude oil inventories or storing refined products instead, and whether we should have the government own all of the oil or whether there are other, more market-friendly approaches to increasing our supply cushion," he said.

Democrats on the committee sug-

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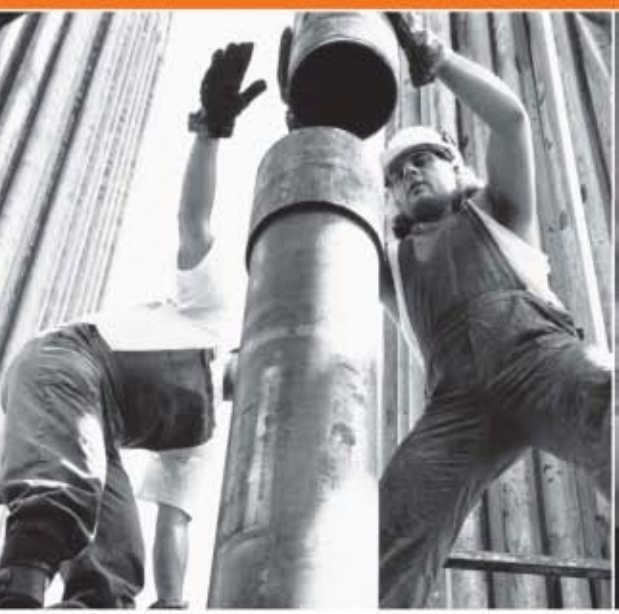

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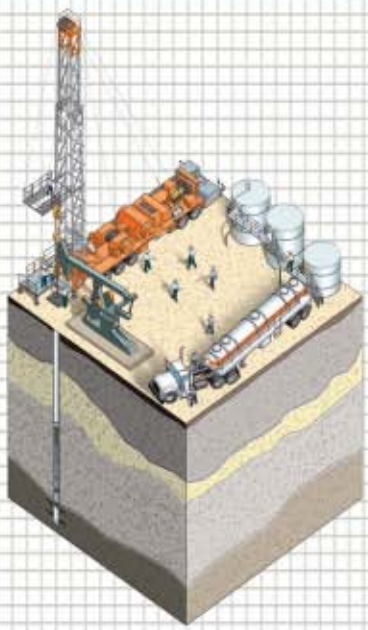

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gested that SPR fill money could instead be added to alternative fuels research and development, while Republicans said it should be used to determine how much crude oil actually is on the US Outer Continental Shelf and in the Arctic National Wildlife Refuge.

In a bill he introduced on Feb. 6, Dorgan calls for suspension of SPR purchases for a year, restoring them only if oil prices fall below (a negotiable) $50/bbl. Money now being spent on SPR fill could be better used, he said, for domestic ultradeep and unconventional drilling research, which the administration repeatedly "zeros out" and which he keeps having to put back into DOE's budget.

"We can expect some push-back from the administration," he told reporters. "I understand that a substantial portion of this is coming from the vice-president's office." Following the hearing, Dorgan said there are several bills to which his measure could be attached as an amendment. ✦

Poor capital efficiency affects UKCS competitiveness

Uchenna Izundu
International Editor

Falling capital efficiency for operators on the UK continental shelf (UKCS) is threatening the area's global competitiveness for upstream investment, offshore trade association Oil & Gas UK has warned.

According to its Activity Survey 2007 report, cost inflation of 15-20%/year is reducing the efficiency of investment, with companies having to spend more money to maintain production from this mature basin. Four years ago, the industry invested £3.4 billion (2003 money) to develop and deliver 1.3 billion bbl of reserves over time. In 2007, £4.9 billion was invested to deliver just 600 million bbl of oil and gas over time.

Operators spent £12 billion last year to explore, develop, and extract the UK's oil and gas reserves. The association believes that investment will remain strong over the next 10 years but stressed that it is important that the UKCS remain competitive to secure interest. The high tax regime is of particular concern to operators and needs to be changed.

The survey shows there are opportunities to sustain investment of £29 billion over the next 10 years, said Mike Tholen, OGUK's economics director. Of that investment, £12 billion is secured, but getting approval for the remaining £17 billion and the development of the associated 2.7 billion bbl of production "will depend on these possible projects competing favorably with those in other basins around the world," Tholen said.

Companies have also seen their operating costs for existing assets rise steeply in 2007. "The new report shows operating expenditure rose by £500 million in 2007 to £6.2 billion and is expected to rise further to around £6.5 billion in 2008, reflecting a steady but substantial increase in expenditure on asset integrity as well as further inflationary pressure on the UKCS," OGUK said.

Gas production fell by 5% in 2007 because of natural decline, Norwegian and Dutch gas imports, and mild weather, which dampened demand. Meanwhile, oil production responded to the start-up of 20 new fields in 2007 and over the year, remained static at 1.6 million bbls. OGUK said 15 more fields are scheduled to come on stream in 2008, and overall production is expected to decline at only 4%/year until the end of the decade.

While exploration and appraisal drilling activity rose in 2007 to 111 wells from 70 wells, the increase was largely the result of appraisal drilling instigated by the need to reduce technical and commercial risks in such a high-cost environment. Operators are finding it very expensive to develop small discoveries on the UKCS.

OGUK said, "Exploration drilling in pursuit of new oil and gas reserves increased in 2007 to 34 wells from 29, two thirds of which were drilled near existing fields. Initial indications are that the accompanying 60% increase in spending on exploration and appraisal to £1.3 billion resulted in 13 discoveries totaling 300-400 million bbl of oil and gas. Despite the increase in spending, however, this was less than was discovered in 2006." ✦

European biofuels policy fraught with problems

Uchenna Izundu
International Editor

Quantity targets to introduce biofuels into the European Union's energy mix should be scrapped in favor of a low-carbon policy approach, according to a senior environmentalist.

Speaking at International Petroleum Week in London, Jos Dings, director of the European Federation for Transport and Environment, said biofuel producers were confused about whether to invest in "cheap or clean biofuels" because member state governments have changed their biofuel targets, creating uncertainty in the market.

Dings said under a low-carbon ap-

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WATCHING THE WORLD

Eric Watkins, Senior Correspondent

Chavez wants to dump Citgo

Is Venezuela's President Hugo Chavez selling off his country's oil and gas assets to pay off debts? Reports say his government is selling overseas assets owned by Petroleos de Venezuela SA (PDVSA) and its US-based refining branch, Citgo Petroleum Corp.

In fact, a share of the proceeds from such sales has been earmarked for the National Development Fund, a mechanism that is increasingly used to pay off domestic expenses.

In net terms, after discounting taxes and standing debts, ever since 2006 the combined revenues from asset sales of PDVSA and Citgo have totaled $3.42 billion, of which $2.77 billion has actually entered Venezuela or is in the process of entering the country.

Most of this money comes from the 2006 dissolution the Lyondell-Citgo association, netting Venezuela about $1.31 billion, which was deposited into the NDF.

Selling the silverware

One year later, Citgo sold its 6.8% stake in the Explorer oil pipeline, as well as a 15.8% share in Colonial products pipeline. Both stakes were valued at $765 million.

A few months later, Citgo sold Nustar, owner of the Paulsboro and Savannah refineries. According to Energy and Petroleum Minister Rafael Ramirez, the $600 million from the sale would be deposited in the NDF.

But a wrinkle has appeared in the sell-off plan in the form of a lawsuit filed in the US by Road Ranger, a chain of travel centers and convenience stores.

Road Ranger became a franchisee of Citgo in 1991 and, in the next 14 years, expanded from four Citgo-branded gas stations to 39, helping build the Citgo brand in America's heartland of Illinois, Wisconsin, Indiana, and Iowa.

Road Ranger has filed claims against Citgo for breach of contract and violations of the Petroleum Marketing Practices Act caused by the Venezuelan firm's unnecessary failure to supply gasoline to Road Ranger gas stations, for damaging the Citgo brand, and for dealing in bad faith.

Damage to Road Ranger

Citgo's actions threatened the existence of the Midwestern chain and caused damages estimated by Road Ranger to be in excess of $30 million. Road Ranger will also be seeking punitive damages under the Petroleum Marketing Practices Act for Citgo's dishonest conduct.

In fact, Road Ranger claims that Chavez further damaged the Citgo brand when he engaged in "vitriolic" personal attacks against the US and President George W. Bush.

"These unrelenting attacks provoked an organized consumer boycott against Citgo gas stations in the US, including boycotts of Road Ranger stores by its customers," the suit states.

"Despite 14 years of promises and its contractual responsibility to supply Road Ranger with gasoline, when we needed them most, Citgo did not even try to help us," said Dan Arnold, Road Ranger's founder and president.

There's a lesson here, we think, especially for those countries, governments, and corporations around the world who think they can do business with Chavez. That lesson is very simple indeed: "caveat emptor." ✦

proach, which is being developed in California, companies would be given signals to invest in low-carbon methods at the cheapest cost. The European Commission has proposed that it will review the fuel quality directive to see if it can use this method instead.

Last month, EC proposed that 20% of its energy mix comes from renewable sources by 2020 compared with 8.5% today. It published a directive to remove the barriers to the growth of the renewables industry so that it can enhance its energy security. EC's proposals will be debated by the Parliament and Council later this year before a decision can be mde on whether they will be adopted or not.

But £30 billion/year to 2030 of investment is required to just build conversion facilities for biofuels, said Peter New, president of global biofuels at BP PLC. "That means building a 300 million gal plant every 5-6 days."

The UK faces a 303 million l. shortfall in biofuel capacity as it aspires to meet its target of 5% of transportation fuel from biofuels by 2010, warned John Seed, managing director of Helius Energy. But producers and the supply chain can deliver the raw materials, he added, because of innovative technology.

Bioethanol and biodiesel are likely to compete against each other depending on oil prices, incentives for developments, and penalties, New said. Challenges facing growth of the industry include regulation, terminal investment, forecourt investment, and product quality. "I think these will be resolved but it will be a bumpy road," New admitted.

New told OGJ that dialogue was essential with the automobile industry to coincide its timetable on producing cars for biofuels. About 80% of the EU's car fleet will turn over in the next 13-15 years. However, the car industry is split among those looking at biofuels and those continuing with diesel-based cars. Views differ also about what work needs to be completed under EU regulations.

"Energy efficiency is paramount to tackling carbon emissions rather than rushing to biofuels," Dings said. "Debating about the distinction between first-generation and second-generation biofuels is useless. The issue should focus on whether biofuels require new land as this is a sustainability issue," he said.

Consolidation of biofuel companies is likely in the future, said Melissa Stark, partner of energy strategy at Accenture. She told OGJ that ageing technology would be a driver in bringing companies together. "Infrastructure development and financial markets will be critical for the next 5 years. People want to see volumes on the market to see prices." ✦

Russia, Serbia sign natural gas pipeline deal, create new firm

Eric Watkins
Senior Correspondent

Russia has signed several agreements for oil and gas with Serbia, largely aimed at underscoring its political support for the Balkan country.

In the main development, Russia and Serbia signed an agreement to create a joint company that will build the Serbian stretch of the South Stream gas pipeline.

According to Dmitry Medvedev, the apparent successor to Russian President Vladimir Putin, the South Stream pipeline deal, valued at some $1.5 billion, will "form the foundation of energy stability for all of Europe in the future."

The statement, alluding to the European need for such gas, followed the decision by the US and several member states of the European Union to recognize the declaration of independence made by the former Serbian state of Kosovo.

Russia sided with Serbia and said it will block Kosovo from joining the United Nations or other international organizations.

Russia's Putin said Kosovo's declaration represented "a terrifying precedent," and he warned the West that the decision would "come back to knock them on the head."

On his visit to Belgrade, Medvedev said Kosovo's declaration of independence violated international law "absolutely," and he insisted, "Serbia needs support now."

That view was rejected by the US Department of State, which said Kosovo will never be part of Serbia again, but that Washington would keep working on the issue with Belgrade and its ally Russia, both of which oppose Kosovo's independence.

"We are going to continue to try to work with both the Russians and the Serbs on this but I think that it ought to be clear to everybody at this point that Kosovo is never going to be a part of Serbia again," said DOS spokesman Tom Casey after Medvedev's visit to Belgrade.

Regarding the South Stream agreement signed by OAO Gazprom Chief Executive Alexei Miller and his Srbijagas counterpart, Sasa Ilic, the new company would draft all details for the pipeline over the next 18 months, including the rights and obligations of the Russian-Serbian enterprise.

"We allocate 3 months for the creation of the company, and another 18 months for the feasibility study," said Gazprom spokesman Sergei Kupriyanov. "We expect construction to start no later than 24 months after the feasibility study has been completed," he said.

Kupriyanov said it is important to negotiate with all the countries participating in the pipeline project—Russia, Italy, Bulgaria, and Serbia, with Bosnia and Greece as possible partners—"so that the feasibility study is integrated."

The $14.65 billion South Stream project by Gazprom and Italy's Eni SPA is designed to carry Siberian gas to Western Europe at a capacity of at least 10 billion cu m/year.

Russia also will invest a further €900 million in Serbia's energy industry, said Medvedev during a visit to a major Serbian oil refinery in Pancevo. He did not detail the expenditures.

However, refinery general director Serzan Bosnjakovic told Medvedev that a facility would be built at the refinery with Russian help by 2010 that "will cost about €500 million" and "meet top modern standards."

"We hope that, with your help, the capacity of the refinery will grow to 7 million tonnes of oil a year," said Bosnjakovic. The refinery currently processes 5 million tonnes/year of oil.

Medvedev said all the documents on the investment plan had been drafted and would be signed "very soon." ✦

COMPANY NEWS

Total reveals $19 billion capital budget for 2008

Total SA plans a $19 billion capital expenditure for this year, with refining and marketing accounting for $2.5 billion and petrochemicals $1.3 billion. The balance is dedicated to upstream, where a $1.8 billion sustained exploration effort is planned.

Other oil and gas companies have recently released their spending plans for 2008. These include:

- Marathon Oil Corp. announced an $8 billion capital, investment, and exploration budget for 2008 compared with 2007 spending of $4.8 billion.
- Suncor Energy Inc., Calgary, has approved a $7.5 billion (Can.) capital spending budget for 2008, about 80% of which will target growth in oil sands projects.
- Anadarko Petroleum Corp. has approved total capital expenditures of $4.5-4.7 billion for 2008, including about 20% for exploration.
- Houston independent Newfield Exploration Co. announced a $1.6 billion capital investment program for 2008, of which $620 million is allocated to the US Midcontinent region.
- Fort Worth independent Range Resources Corp. reported capital spending plans totaling $1.065 billion for 2008. This represents an 18% increase over the company's 2007 budget.
- Petrohawk Energy Corp., Houston, boosted its 2008 capital budget to $800 million from $700 million last year.
- Houston independent Ultra Petroleum Corp. approved a 2008 capital budget of $755 million compared with $714.5 million spent in 2007.
- Brigham Exploration Co. said its board approved a $134.4 million capital expenditure budget for 2008.

Total

Last year, Total dedicated $16 billion and added 1 billion boe from exploration. Total Chief Executive Christophe de Margerie said, "We will find barrels by exploration and not acquisition."

Total's upstream production last year grew by 1.5% over 2006 to 2.39 million boe/d, de Margerie reported.

De Margerie maintained his expectations of an average 4%/year production growth to 2010 based on $60/bbl Brent crude. At $80/bbl, production would be less by 50,000 b/d in 2010 under production-sharing contracts.

De Margerie said although 2008 production is uncertain because of the current economic and geopolitical environment, "even at an $80/bbl, [2008 production] will exceed that of 2007." Total is banking on new fields due on stream in Yemen and Congo, and the ramping up of Anguille in Gabon, Dolphin in Qatar, and Rosa in Angola.

The group's proved reserves replacement rate fell to 23% from 102%, partially because renegotiation of the Sincor contract in Venezuela reduced Total's stake to 30% from 47%.

Maintaining a proved reserve life of 12 years and proved and probable reserve life over 20 years will require development of new capacities, he said. Numerous projects extending to 2015 should bring production close to 3.3 million boe/d.

Marathon Oil

Marathon's increased spending stems primarily from a 180,000 b/cd expansion at its 245,000 b/cd Garyville, La., refinery, the Athabasca oil sands project in Alberta, and an associated expansion and heavy oil upgrade at its 100,000 b/cd Detroit refinery (OGJ, Nov. 12, 2007, Newsletter).

Clarence P. Cazalot Jr., Marathon president and chief executive officer, noted that "reinvestment in the business

will contribute much-needed growth in US refining capacity."

Marathon's 2008 worldwide exploration and production budget of $3.2 billion is a 23% increase over last year's E&P budget. Worldwide production capital spending in 2008 is projected at $2.1 billion, up 37% from last year.

Refining, marketing, and transportation spending is expected to total $3.5 billion in 2008, up from $1.7 billion in 2007.

Suncor Energy

Suncor's budget for oil sands projects will enable the expansion this year of in situ bitumen production capacity to 350,000 b/d and support future construction of a third upgrader to increase oil sands production capacity to 550,000 b/d in 2012.

Another $1.5 billion is allocated for existing operations. About $1.2 billion of that will enable construction of Suncor's North Steepbank mine extension (which will replace bitumen from mined-out areas), a planned maintenance shutdown of Upgrader 1 in the second quarter, projects to improve reliability and productivity of oil sands assets, and emissions-control equipment.

About $275 million also will support production of 205-215 MMcfd of gas equivalent in 2008.

Downstream plans this year call for $225 million for sustaining operations following growth projects at two refineries during the past 2 years at Sarnia, Ont., and Commerce City, Colo.

Anadarko Petroleum

Anadarko expects 2008 oil and gas production to reach 205-210 million boe and says it will bring Blind Faith field in the deepwater Gulf of Mexico on stream.

Of the company's proposed outlays, 30% will be spent in the Rocky Mountains, 20% in the US Southern region, 25% in the deepwater Gulf of Mexico, 15% for international and frontier activities, and 10% for midstream facilities.

Anadarko plans to drill 2,700-3,000 development wells in resource plays onshore in the US—85% in the Rocky Mountains, and 15% in its Southern region, including the Delaware basin, Eastern Chalk, and Carthage areas of Texas.

In the Rocky Mountain region Anadarko also will add a cryogenic processing facility at its Chapita plant in Greater Natural Buttes to double processing capacity to 500 MMcfd, and will add 400 MMcfd of gathering capacity at the Fort Union system in the

PERSONNEL MOVES AND PROMOTIONS

Imperial appoints successor to retiring chairman, CEO

Imperial Oil Ltd., Calgary, has named **B.H. March**, currently president, to succeed current Chairman and Chief Executive Officer **T.J. Hearn**, who will retire Mar. 31.

March also serves as director of refining for Europe, Africa, and the Middle East for ExxonMobil Petroleum & Chemical BVBA in Brussels. Previously he has held management positions in ExxonMobil's refining, supply, and environment, health, and safety divisions.

Other moves

Bois d'Arc Energy Inc. promoted **Greg T. Martin** to chief operating officer.

Martin joined Bois d'Arc Offshore in July 1998. Before joining Bois d'Arc, he worked for Amerada Hess and Newfield Exploration Co.

Separately, the company promoted **James P. Perkins** to vice-president, land.

MegaWest Energy Corp., Calgary, has appointed **R. William Thornton** president in addition to his duties as chief operating officer.

Thornton has been MegaWest's chief operating officer since Jan. 1, 2007. **George T. Stapleton II** will remain MegaWest chairman and chief executive officer.

Previously, Thornton was Western Oil Sands general manager of petroleum engineering. Prior to that, he worked for Petrovera Resources, Gulf Canada, and Murphy Oil.

Penn West Energy Trust, Calgary, has appointed **Murray R. Nunns** president and chief operating officer.

Separately, **David W. Middleton** was promoted to executive vice-president, operations and business development. Middleton has worked in Penn West's senior management since 1999.

Nunns has 29 years of oil and natural gas experience. Since 2003, he has been involved in the formation and management of several public and private oil and gas companies.

From 1992 to 2002, Nunns held various management positions at Rio Alto Exploration Ltd., including executive vice-president of exploration and development as well as chief operating officer.

Conlon

Houston independent Yuma Exploration & Production Co. has promoted **Michael F. Conlon** to president and chief operating officer. Conlon joined Yuma in November 2002 as vice-president, exploration. Conlon has more than 35 years of US and international experience in oil and gas exploration.

Before joining Yuma, Conlon worked as vice-president, exploration, for Pluspetrol SA in Buenos Aires.

National Fuel Gas Co. (NFGC), Williamsville, NY, has named **David F. Smith** chief executive officer.

Smith, who joined NFGC in 1978, will continue to serve as president and chief operating officer. Smith also has served as president of National Fuel Gas Supply Corp., Empire State Pipeline, National Fuel Resources Inc., and National Fuel Gas Distribution Corp. (NFGD).

Separately, current Chief Executive **Philip C. Ackerman** will retire effective June 1 but will retain his role as chairman. Ackerman, who joined the company in 1968, previously served as president, chief financial officer, and president of Seneca Resources, NFGD, and Horizon Energy Development Inc.

Enid, Okla., independent Ward Petroleum Corp. has named **Mark Jopling** operations manager.

Jopling was initially employed by Halliburton Services Co. as a field and district engineer in various locations in north Texas and northwest Oklahoma where he designed and implemented cement work, fracture stimulations, and drillstem testing.

He joined Ward in April 1981 as a staff engineer, primarily with drilling and completion responsibilities, and later became a senior staff engineer assisting with daily operations.

BreitBurn Energy Partners LP, Los Angeles, reorganized its operations group into Western, Central, and Eastern divisions and set up an operations management team led by **Mark L. Pease**, chief operating officer since December 2007.

Chris Williamson was promoted to senior vice-president, production operations and Western division. He will be responsible for companywide production operations. He was vice-president, operations, and joined BreitBurn in 1994.

Dave Baker was promoted to vice-president, reservoir engineering and Central division. He will be responsible for companywide reservoir engineering and evaluation of existing properties and acquisition candidates. He will manage the Wyoming, Texas, and Florida asset teams. He joined BreitBurn in 1999.

Dwayne Stewart was promoted to vice-president, geosciences and Eastern division, and will manage geoscience work in all of the company's asset teams. His geographic responsibility is Michigan, Indiana, and Kentucky. He joined BreitBurn in 2006.

Williamson, Baker, and Stewart will work from BreitBurn's Houston office.

Hyperdynamics Corp., Sugar Land, Tex., has named **Jim Spear** vice-president and chief geologist. Spear joined the company in November 2007.

Hyperdynamics is an oil and gas exploration company founded in 1996 and is currently exploring off Guinea. It holds the largest exploration license in West Africa, covering 31,000 sq miles.

Powder River basin, bringing its total capacity to 1.3 bcfd.

In the deepwater gulf Anadarko will focus on development drilling, particularly in the eastern gulf and the K2 unit, and will drill 6-8 exploration and appraisal wells targeting Miocene and Lower Tertiary objectives.

Anadarko has allocated most of its international capital toward projects in Brazil, Alaska, Algeria, and China, including deepwater activities in West Africa, the South China Sea, and Peregrino field off Brazil.

Newfield Exploration

Newfield plans to devote $460 million of its Midcontinent spending to the Woodford shale in southeastern Oklahoma's Arkoma basin. The company has 165,000 net acres in the Woodford shale.

The Woodford program calls for Newfield to drill and operate 100 horizontal wells this year. Newfield also plans to participate in 60-70 nonoperated wells there.

Newfield plans to spend $310 million in its Rocky Mountain region operations, $245 million on land wells across Texas, and $240 million on Gulf of Mexico projects.

Internationally, Newfield plans to spend $155 million. In Malaysia, Newfield plans to start production this year in Puteri and East Belumut-Chermingat fields.

Range Resources

Range Resources' budget this year includes $783 million for drilling and recompletions, $109 million for land, $51 million for seismic surveys, and $122 million for the expansion and enhancement of gathering systems and facilities.

Of the drilling and recompletion capital, 95% is attributable to lower-risk development and exploitation activities, and 5% is attributable to exploration projects, Range said.

This year Range expects to drill 968 gross (715 net) wells and undertake 82 (66 net) recompletions. About 56% of the budget is attributable to the US Southwest region, 40% to the Appalachian region, and 4% to the Gulf Coast region.

Included in the budget are 187 net coalbed methane, tight gas, and shale wells in Nora-Haysi field in Virginia, 92 net Barnett shale wells in the Fort Worth basin, and 60 net Marcellus shale wells in Appalachia.

The remaining 376 net wells are primarily tight gas and oil wells in the company's other core areas.

Petrohawk Energy

Petrohawk raised its spending plans

based on several corporate developments, including recent acquisitions that provide growth opportunities, expansion on exploratory success at Elm Grove and Terryville gas fields in northwestern Louisiana, and initial positive drilling results in the northern part of the Arkansas Fayetteville shale gas acreage holding.

The company, which was operating 18 rigs in late January, expects the 2008 program to involve 22 operated rigs to drill 350 operated wells.

The Elm Grove budget is $293 million for 140 planned operated wells. Petrohawk closed a $169 million acquisition of properties in the field. It has spud an offset to its first horizontal Lower Cotton Valley Taylor sand well, Killen 13-3H, which came on line at 16.5 MMcfd at yearend 2007.

The Fayetteville shale budget is $278 million for 150 operated and 50 nonoperated wells. The company brought on production 20 wells in 2007 in the Hurricane prospect in Van Buren County that averaged 2.3 MMcfd/well for 30 days.

Ultra Petroleum

Ultra expects its 2008 production to reach 135-140 bcf of gas equivalent, 18-22% higher than its 2007 production. Ultra plans to drill 26 delineation wells in 2008 under its 5-year plan to drill 120 delineation wells.

Michael Watford, chairman, president, and chief executive officer, said the company plans to drill 240 gross (113 net) wells in Wyoming. About 20% of the net wells will be devoted to delineation.

"It is extremely important for us to continue defining the Pinedale field so we can get our arms around the actual size of the resource," Watford said.

Ultra develops long-life natural gas reserves in Pinedale and Jonah fields. The company increased its 2009 production target to 170-175 bcf of gas equivalent from its previously announced target of 160-165 bcf of gas equivalent.

Brigham Exploration

The Austin, Tex.-based independent plans to spud 33 wells in 2008 with an average working interest of 54%. About 76% of the 2008 capital budget is allocated to drilling expenditures, a 6% increase compared with 2007.

Brigham plans to spend $52.4 million on its Rocky Mountain region where it expects to drill 17 wells in the Williston basin. The company also will spend $51.7 million on its onshore Gulf Coast region. Another $13.6 million of the 2008 exploration and development capital expenditures will be allocated to the Anadarko basin. ✦

Pinedale, Jonah gas fields see expanding development

Alan Petzet
Exploration Editor

Rapid development progress at giant Pinedale and Jonah gas fields in Southwest Wyoming is evident in the yearend financial and operating figures of Ultra Petroleum Corp., Houston.

The two Green River basin fields rank among the top six US gas fields by reserves, said Michael D. Watford, Ultra chairman, president, and chief executive officer.

EnCana Corp. and BP PLC have the two largest positions in Jonah, and Ultra is third. Jonah field, with 1,000 wells on 36 sq miles, has an estimated 13.6 tcf in place, of which EnCana estimates slightly more than 60% will be recovered, Watford said.

Pinedale, where Ultra has the largest land position, covers 90 sq miles and began to develop 4-5 years after Jonah. Pinedale has 48 tcf of OGIP, and EnCana suggests 57% recovery there. Pinedale is only 8% developed.

Each field is producing more than 1 bcfd of gas.

Ultra in 2008 looks forward to more year-round field access at Pinedale and plans to accelerate delineation drilling, continue development drilling, work on a downspaced 5-acre pilot, evaluate nonsand pay projects to add incremental reserves, and explore deeper formations, Watford said.

The company, envigorated by startup of the Rockies Express pipeline to the eastern US, will nearly double in 2008 the number of Pinedale delineation wells it drilled in 2007.

Ultra is the only entity with production in both fields, Watford said, but Newfield Exploration Co., Houston, is now drilling in both.

2008 status

Ultra's board in late February approved a 2008 capital budget of $755 million, up from the $714.5 million spent in 2007.

The company forecasts that its production, which comes from Pinedale and Jonah, will total 135-140 bcfe this year compared with 114 bcfe in 2007. Its forecast is for production of 170-175 bcfe in 2009 and a preliminary 200-205 bcfe in 2010.

It plans to drill 26 delineation wells in 2008 as part of a 5-year, 120-well delineation program.

Ultra's yearend 2007 proved reserves were 2.98 tcf of gas equivalent, up 25% on the year.

"More importantly," the company said, "the third party identified, engineered, and economic resource base net to Ultra in Wyoming has grown from 9.9 tcfe to 10.7 tcfe, well on our way to the 12 tcfe target."

The company identified 5,300 undrilled locations at the end of 2007, up 650 from a year earlier.

Ultra calculated its 2007 finding and development costs at 98¢/Mcf, down from $1.10 in 2006. The $4.66/Mcf realized gas price in 2007 was a 22% decline from 2006, but Ultra's net income margin from continuing operations was 32% and its return on capital 27%. The company sold its China Bohai Bay interests, which did not contribute to fourth quarter 2007 production.

Ultra's fourth quarter production totaled 32 bcf of gas and 255,300 bbl of condensate. Fourth quarter condensate price was $79.84/bbl in 2007 and $57.06/bbl in 2006.

Field operations

Ultra-interest Pinedale completions in 2007 averaged initial flow rates of 8.8 MMcfd with a maximum of 20.8 MMcfd from Upper Cretaceous Lance, Watford said.

The formation averages 1,400 ft of net pay in a 5,600-5,700-ft gross interval.

After 20-25 large fracs at $100,000/stage, the typical well comes on at a high rate, produces 20% of estimated ultimate recovery in the first 2 years, declines rapidly for 2-3 years, and then flattens for an expected 40-50-year producing life.

Ultra drilled 212 gross (105 net) wells in 2007. Its Pinedale drilling aver-

aged 35 days/well from spud to total depth, compared with 61 days in 2006.

It drilled the Warbonnet 4D1-9 well from spud to TD 13,175 ft in 17.5 days, surpassing the previous 18.6-day record, and drilled 75% of the 2007 Pinedale wells in 40 days or less. Before 2007, 41 days was the record.

Ultra attributed the improvement to the use of oil base mud, new drillbit technology, and rig fleet upgrades.

The company placed on production 193 gross (90 net) wells in 2007 vs. 124 (57) in 2006 in Wyoming.

Delineating Pinedale

Ultra had 11 operated rigs and another 12 nonoperated rigs running at Pinedale at the end of 2007. Five rigs are on delineation wells, and the company has identified 100 quarter sections for delineation drilling at Pinedale.

"Current plans call for continuing the delineation drilling effort for at least the next 5 years in ongoing efforts to fully define the ultimate potential of this gigantic asset," the company said.

Ultra said 13 of the planned 17 delineation wells for 2007 had sufficient production history by late February 2008 to estimate reserves. For those 13 wells, reserves averaged 31% better than the 2006 yearend reserve estimates by consulting engineers. Early 2008 delineation results continued to show great success, the company added.

Consulting engineers assigned Boulder 9B1-19, a delineation well in east-central Pinedale, 8.6 bcfe of EUR after it came on at 11.6 MMcfd. Farther south, Boulder 10D-32 came on at 11.9 MMcfd and was assigned 6.8 bcfe of EUR.

"The combination of these wells on the east side of Pinedale expands Ultra's reserve mapping and removes the area previously known as the 'Boulder Gap,'" the company said.

Meanwhile, Riverside 10C1-25 on Pinedale's western edge came on at 9.8 MMcfd.

Nonsand and deep work

Ultra said its program to return to older Pinedale wells to stimulate and complete nonsand intervals, although still early, indicates that the bypassed pays "appear to add materially to the overall reserves and production at only the additional cost of the extra frac jobs."

It may take 18-24 months to understand how much more reserves are being added, Watford said. Early results indicate the cost to be about $1/Mcf.

By late February, Ultra had completed 19 wells in nonsand intervals and run production logs of 12 of them.

"These production logs indicate that the flow rates from the 63 additional frac stages pumped in this test have averaged over 100 Mcfd/stage," Ultra said.

On 8 of the 12 logged wells, a second production log confirmed that the nonsand stages are performing similarly to typical Lance sand intervals.

Separately, the Ultra and Shell Western E&P Mesa 10D-33 exploration well in central Pinedale was drilling at 17,878 ft in the Blair in late February after topping Blair at 16,204 ft. It is expected to TD at 19,500 ft by early March.

The Blair section appears to contain a large thickness of potential pay sand with better porosity than encountered at the Questar Corp. Stewart Point 15-29 well (OGJ, Dec. 4, 2006, p. 35). That well proved gas in the Cretaceous Blair and Hilliard shales, Watford noted, but had mechanical problems and was completed uphole in the Lance.

Land and pipelines

Pipeline capacity and land access both appear to be opening up at Pinedale field.

With start-up of the Rockies Express pipeline in early 2008, Ultra is "getting the best gas prices we ever received in the Rockies, well above $7," Watford said.

Rockies Express is important to Ultra, an anchor shipper, because it enables the company to deliver gas east of the Rocky Mountains for the first time. Within weeks, the pipeline will become fully operational from Opal, Wyo., to a connection with Panhandle Eastern Pipeline near Columbia in Audrain County, Mo.

Not long ago, the northern Rockies had 6.6 bcfd of takeaway capacity. Rockies Express added 1.5 bcfd and will expand to 1.8 bcfd. Several other systems are planned, perhaps led by El Paso Corp.'s 1.2 bcfd Ruby pipeline to northern California, and another pipeline of similar size to Chicago is under discussion.

A final environmental impact statement regarding Pinedale, expected in the second half of 2008, is likely to authorize year-round access to drill and complete wells in most parts of the field while still leaving some large areas for wildlife migration, Watford noted.

The EIS envisions as many as 40-45 rigs operating at Pinedale, compared with the 28 working today, he said. ✦

EOG to corner North Dakota Bakken play

EOG Resources Inc. booked 21 million boe of proved reserves in Parshall field in the North Dakota Bakken shale oil play by yearend 2007 and is still comfortable with its previous estimate that net reserves will eventually reach 80 million bbl.

The multiyear Williston basin play is the major driver of EOG's 36% growth target in oil and condensate production in 2008, the company told investment analysts earlier this month. EOG averaged 24,600 b/d of crude and condensate in the US in 2007 and 27,600 b/d in the quarter ended Dec. 31.

The company's best horizontal wells, in the northern part of the play, have had initial production rates of 2,000 b/d, and the last 10 completions averaged 1,700 b/d and 700,000 bbl/well of reserves.

"We feel we have a considerable amount of technically proven but unbooked reserves in the Bakken, Barnett, and Uinta basin plays," said Mark Papa, EOG chairman and chief executive officer.

EOG said it has 24 producing wells on more than 175,000 acres in what it believes is the most economic area, is acquiring more acreage, and plans to reveal more about the play in late February. It said it has leased the vast majority of the play area.

The company, which is still defining the productive area's extent, is drilling its first 320-acre downspaced well in the play, explored so far on 640-acre spacing. Recovery factors at 640-acre wells are very low, and it will be late December before it can observe the downspaced well's flow rates relative to offset wells, EOG said.

The company said it is seeing declines of 5-10% lately in rig rates and stimulation costs compared with 2007 in the Bakken.

It plans to start up a gas processing plant in March because the Bakken casinghead gas is especially high in natural gas liquids content.

EOG said it is exploring in other "shale and unusual rock plays" in the US that involve horizontal drilling and will only discuss those efforts after they have been technically proved and the company has leased the acreage it seeks.

EOG is experimenting with horizontal drilling in a couple of resource plays in the East Texas-North Louisiana-Mississippi area, which are run from its Tyler, Tex., office. It said drilling in these plays has been 100% vertical to date, and Papa said it might have some good results to report in 2008.

In a joint venture, EOG and National Fuel Gas Co., Buffalo, NY, have drilled vertical and horizontal wells to Devonian Marcellus shale in the northern Appalachian basin, but it is too early to discuss results, Papa said. ✦

Atlas sees 4-6 tcf recovery from Marcellus shale

Philadelphia operator Atlas Energy Resources LLC said it has determined that it could ultimately recover 4 to 6 tcf of natural gas from the Devonian Marcellus shale on its properties mostly in southwestern Pennsylvania.

Atlas Energy controls 483,000 acres in Pennsylvania, New York, and West Virginia and is aggressively adding land.

After reviewing the length of its hydraulic fracs, the company said it believes it will be able to develop the formation with vertical wells on 40-acre spacing. That would give it 4,000 to 6,000 potential locations in southwestern Pennsylvania, where it is concentrating on 224,000 acres and where it has drilled all but one of its Marcellus wells.

Almost all of the southwestern Pennsylvania acreage has ample pipeline capacity that is controlled by the company's affiliate, Atlas Pipeline Partners LP.

Atlas Energy has drilled 27 vertical wells to date, 21 of which are producing into a pipeline. The other six are to be connected shortly. The company believes it has largely delineated its acreage.

Analysis by consulting engineers implies finding and development costs of about $1/Mcf, said Richard D. Weber, Atlas Energy president and chief operating officer.

Weber said, "While the finding and development costs of our vertical drilling program compare favorably with the reported results from horizontal drilling of other shale operators in the Appalachian basin and elsewhere, we believe that our horizontal drilling program has the potential to even further enhance our economic returns from the Marcellus shale."

Atlas Energy, which has drilled one horizontal Marcellus well in southwestern Pennsylvania with an industry partner, plans to drill at least four more horizontal wells in 2008.

Consulting engineers Wright & Co. Inc. assigned 961 bcf/well of proved reserves to Atlas Energy's first 14 southwestern Pennsylvania Marcellus wells, including five initial wells to which the company applied first-generation completion techniques.

For the nine later wells where the company used advanced drilling, completion, and production techniques, the consultant assigned reserves that averaged 1.3 bcf/well and were as high as 1.8 bcf.

Since adopting the advanced techniques, the company's initial 24-hr rates into a pipeline have averaged 1.3 MMcfd and have been as high as 2.6 MMdfd.

"Based on published reports, to the company's knowledge, these are the best initial daily production rates of any vertical wells in the Marcellus play. In response to these results, Atlas Energy plans to drill and complete at least 150 vertical Marcellus shale wells over the next 18 months," the company said. ✦

OGJ author's guide available

The Oil & Gas Journal exploration editor is pleased to receive manuscripts on all exploration related subjects from new or experienced authors worldwide. OGJ accepts exclusive articles and manuscripts condensed from oral presentations. A brief author's guide outlining our needs and answering other questions is available from: Exploration Editor, Oil & Gas Journal, 1455 West Loop South, Suite 400, Houston, TX 77027; Ph. (713) 963-6292; Fax (713) 499-6310; email to alanp@pennwell.com

Dubai contracts first new Maersk jack up

Nina M. Rach
Drilling Editor

Maersk Contractors is building four identical independent leg cantilever jack ups with an innovative XY cantilever design at Keppel FELS in Singapore. The first rig, the Maersk Resilient (Fig. 1), was named on Jan. 30, 2008, and will travel 3,472 nm nautical miles to Dubai for a 3-year contract with state-run Dubai Petroleum Establishment (DPE).[1] The rig should arrive in Dubai by the end of this month, following a 3-week mobilization to the Persian Gulf."

Design

The design team for the MSC CJO-X100 MC project (Fig. 2) included 20 experienced jack up rig crew and engineers from Maersk and Netherlands-based Marine Structure Consultants (MSC). The team incorporated features from two existing ultraharsh environment jack ups, Maersk Innovator and Maersk Inspirer, in the new design.

The new rigs have a large, open deck space of 2,143 sq m and will be equipped to drill deep, difficult wells, and handle high temperature and high-pressure conditions. The design includes automated systems that will speed up the drilling process and make it safer for righands. Dual assembly lines with 45-ft and 60-ft mouse holes will make it more efficient to build stands offline. The derrick is tall enough to accommodate drill pipe in stands of four joints ("fourbles"), although offline pipe handling and storage is limited to stands of three joints.

XY cantilever

The XY cantilever design was pioneered on the Maersk Innovator.[1] The cantilever can skid transversely (X) as well as longitudinally (Y) and eliminates the need for a transverse skidding substructure. The rig can skid transversely and the rig can move with pipe in the derrick, saving time between wells, Maersk says.

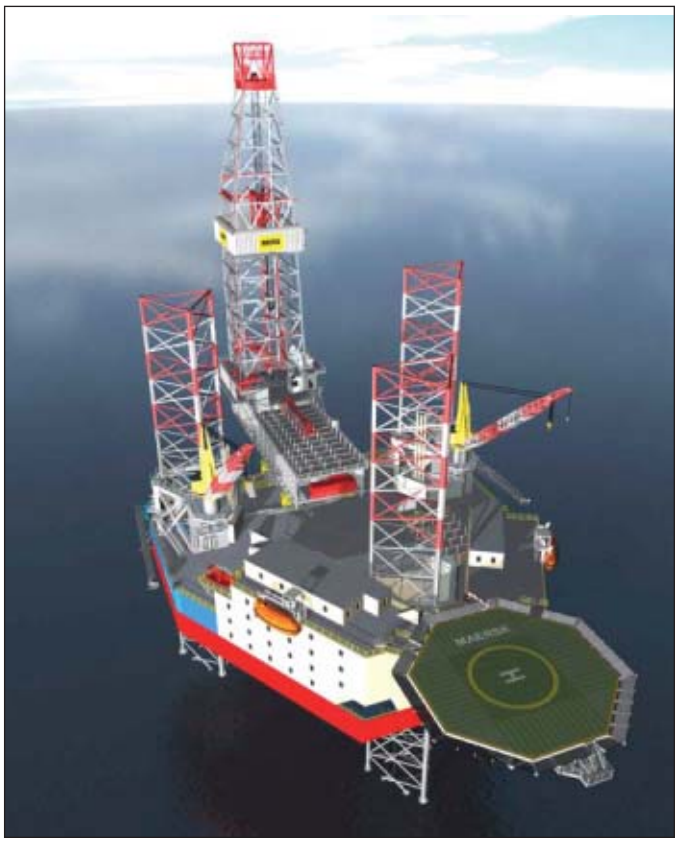
The XY cantilever has a 70-ft reach from stern to well center and a transverse reach of 46 ft. Maersk can alter the design further, "similar to what was done to Maersk Inspirer," where cantilever reach was extended to 100 ft from the original 90 ft.[1]

The cantilever deck is raised more than 3 m above the main deck, and the space underneath is available for storage. The length of the cantilever accommodates two pipe racks with capacity to store 30,000 ft of drill pipe (3½-in. to 6⅝-in. diameter) and up to 13,330 ft of casing simultaneously.

Fluids

The rig has a 7,500-psi mud system

Maersk Resilient is the first of four new jack ups, shown here at Keppel FELS in Singapore (Fig. 1, image from Maersk Contractors).



Marine Structural Consultants BV and Maersk designed the new 350-ft CJ-0-X100 MC cantilevered jack up (Fig. 2, image from Maersk).

with three Wirth TPK 7½-in. x 14-in., 2,200-hp pumps, and a slurrification unit with a 2,500-bbl slurry holding tank. There are 12 mud pits, including 4 slug or chemical pits and 4 mud storage tanks, with a total capacity of 6,000 bbl. There is an auto mixing system that reduces or eliminates manual mixing and a chemical dosing system that reduces human exposure to chemicals.

To handle mud returns, there are four Swaco BEM 650 shale shakers and two Swaco vacuum degassers.

A dual drilling fluid system allows rig hands to "hot swap" or easily change between mud and completion fluids.

Safety

A computer-assisted drilling system and mechanized pipe handling will provide a safer working environment on these new rigs. Maersk crews are being trained with 3D simulators that allow them to practice with software controlling all rig floor equipment.

The drill floor of the Maersk Resilient includes the new Torque Master iron roughneck, which can handle drill pipe, collars, casing, tubing, and liners up to 20-in. diameter (Fig. 3, image from Maersk).

Workers also train on full-scale equipment at vendor sites.[2]

The drilling instrumentation system, Drill View, was designed by Maritime Hydraulics and is operated from chairs with joysticks and touch screens in an

MAERSK CONTRACTORS HIGH-EFFICIENCY JACK UPS

Design	MSJ CJ50-X100 MC
Hull dimensions	70 m x 68 m x 9.5 m (229 ft x 223 ft x 31 ft)
Leg length	146 m (479 ft)
Jacking speed	1.47 fpm
Rated water depth	350 ft; 300 ft harsh environment
Rated drilling depth	30,000 ft
Derrick	64 m x 14 m x 14 m (210 ft x 45 ft x 45 ft)
Cantilever reach	
Stern to well center	21.3 m (70 ft)
Center line to side	14 m (46 ft)
Combined cantilever load	1,240 tonnes
Racking capacity	30,000 ft drill pipe + 13,300 ft casing
Variable load	4,500 tonnes, incl. combined drilling load
Hoisting capacity (static hook load)	1.5 million lb
Drawworks	
Wirth GH 4500 EG-AC	4,500 hp; 3 AC motors
Traveling block	
Maritime Hydraulic AS	680 tonnes
Top drive	
Maritime Hydraulic DDM-750-AC	680 tonnes Max. continuous torque 64,400 ft-lb Max. intermittent torque 87,800 ft-lb
Rotary table	
Maritime Hydraulic type RTSS	49.5-in., 99,500 ft-lb torque, 40 rpm, max. load 800 tonnes
Iron roughneck	
Maritime Hydraulic Torque Master	Handles 2⅞-in. to 20-in. diameter tubulars
Cranes	
Main	Two, each with 155 ft boom, 80 tonne static load, 40 tonne dynamic load
Knuckle boom	82 ft reach, 12 tonne load, 5 tonne winch
Power supply	
Generator sets	Four A. Van Kaick/DSG 114M1, each 2,655 kva@cosq 0.9; total 10 mW
Well control equipment	
Hydril compact, 18¾-in., single-stack BOP	One 10,000 psi annular preventer
BOP	Two 15,000 psi double-ram preventers
Diverter system	500 psi
Cement system:	
Cement pump	15,000 psi
Bulk cement capacity	200 cu m (7,050 cu ft)
Mud system:	
Wirth TPK 7½-in. x 14-in. pumps	Three, 2,200 hp, 7,500 psi rating
Swaco BEM 650 shale shakers	Four
Swaco vacuum degassers	Two
Bulk mud capacity	300 cu m (10,550 cu ft)
Liquid mud capacity	6,000 bbl
Fluid capacities	
Drill water	5,500 bbl
Brine	3,145 bbl
Potable water	2,750 bbl
Slurry tank	2,500 bbl
Accommodation	120 people

air-conditioned driller's cabin. A CCTV camera is programmed to automatically follow the drilling sequence in order to offer the driller the best view of operations.

Handling

Tubulars are managed with a knuckle boom crane, automated pipe handler, block retract system, top drive, and Torque Master iron roughneck. The knuckle boom crane is installed on the cantilever deck and moves individual pipe joints to the tubular feeding machine; this eliminates the need for manual handling when pipe stands are made up or broken out. Stands are assembled and can also be stored on the cantilever deck.

The knuckle boom crane can also move nontubular equipment (subs, elevators) between the drill floor and the heavy tool storage area inside the cantilever.

The pipe racker can handle tubulars in the range of 3½-in. to 14-in. diameter.

The Torque Master is a new hybrid, which makes up drill pipe and casing and is equipped with a torque and turn system. It can handle tubulars in the range of 2⅞-in. to 20-in. diameter (Fig. 3).

The Maritime Hydraulic DDM-750-AC top drive is powered by a single air-cooled AC motor. The drawworks and traveling block are grooved for 1¾-in. drill line.

The deck cranes have a static lift capacity of 80 tonnes and a dynamic lift capacity of 40 tonnes and are capable of lifting any coiled-tubing unit.

Comparison

The new MSC CJ50-X100 design is comparable to the Friede & Goldman (F&G) JU-2000A/E jack ups.[3,4] The MSC and the JU-2000A are designed for 350-ft water depth (300 ft in harsh environments) and can drill to 30,000 ft. The JU-2000E is an extended-leg design and rated for 400 ft water depth. They all have triangular truss legs, an accommodation module that wraps around the forward leg, and deck cranes mounted on the jacking structures, increasing available deck space. The JU-2000A legs are slightly longer than the MSC design (493 ft vs. 479 ft) and the JU-200E legs are even longer at 548 ft.

The cantilever is slightly longer on both JU-2000 designs (75 ft vs. 70 ft for the CJ50-X100). Drilling capacities (cantilever and hook loads) are similar for the MSC design and the JU-2000A but slightly higher on the JU-2000E.

The Wirth drawworks of the CJ-0-X100 offer 4,500 hp, but the drawworks on the JU-2000E are 3,000 hp.

The MSC design also has a taller derrick (210 ft vs. 170 ft on both JU-2000 designs) and accommodates 20% more personnel than the JU-2000A. But the JU-2000E is designed for a 750-tonne top drive, while the new MSC jack ups will have only 680-tonne top drives.

There is a large disparity in the fluid capacities. The MSC design includes larger storage for potable water (2,750 bbl vs. 1,531 bbl) and has slightly more bulk storage capacity (7,050 cu ft cement and 10,550 cu ft bulk mud)—17,600 cu ft vs. only 15,750 cu ft on the JU-2000A. The MSC design also has larger liquid mud capacity—6,000 bbl vs. only 3,745 bbl on the JU-2000A.

But the JU-2000 stores 21,270 bbl of drill water, considerably more than the 8,645 bbl (5,500 bbl drill water

and 3,145 bbl brine) on the MSC CJ-0-X100.

Dubai

Last year, the Emirate of Dubai took control of its four offshore fields (Falah, Fateh, SW Fateh, Rashid) and 70 platforms from Dubai Petroleum Co., a consortium led by ConocoPhillips (OGJ, Nov. 5, 2007, p. 66). UK-based Petrofac Ltd. and newly acquired subsidiary SPD LLC began a turnkey contract with the government to manage Dubai's offshore facilities, production, and well operations on Apr. 2, 2007.

On Jan. 18, Petrofac announced a joint agreement with DPE to establish the Dubai Petroleum Training Center (DPTC) at DPE's office in Dubai. The center will provide safety and technical training and will open mid-2008.

Fleet

Maersk owns and operates a fleet of 18 drilling units, including one semisubmersible, one 375-ft jack up, 6 ultraharsh environment jack ups, and 10 drilling barge rigs.

The company has eight additional rigs under construction, including the four new high-efficiency 350-ft jack ups discussed in this article, one new 375 ft jack-up rig, and three deepwater development semisubs.

The next three MSC 350-ft jack ups will be delivered from Keppel FELS over the next 15-20 months. All the other rigs will be delivered by 2010. ✦

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Aluminum tubulars make efficient drillstring

Ferda Akgun
Petroleum Institute
Abu Dhabi

Eric Maidla
Slider LLC
Houston

This article examines the difference in axial stresses of aluminum and steel tubulars during drilling and concludes that aluminum tubulars can reduce cost and extend the reach of drilling operations.

The cost of drilling depends on the size and weight of the equipment employed to drill the well. Density of tubulars is an important parameter that has significant impact on the capacity and size of drilling equipment required. It may be possible to reduce drilling costs by employing oil well tubulars made of materials lighter than steel.

It is well known that aluminum is widely available and less expensive than steel. So for the purpose of reducing drilling costs, why not use aluminum tubulars in oil well drilling?

The choice of material dictates both the tubular stresses and strength. This article discusses the technical viability of employing aluminum-based tubulars in oil well drilling and assesses the tubular stresses expected during common drilling operations with aluminum and steel tubulars.

Design

When designing a drilling tool and components, engineers take anticipated loads and stresses into consideration and select components to meet or exceed the maximum anticipated stresses.

The required strength of oil well drilling equipment depends primarily on maximum anticipated stresses and safety factors. These stresses include tension, compression, pressure, bending, and torsion.

Axial stress (tension and compression) is important, either directly or indirectly, in a number of design aspects. For instance:

• The hanging weight of casings and drillstrings sets the requirements for axial strengths of downhole tubulars and the sizes of the drilling lines that are strung through the crown and traveling block.

• Derrick legs are in compression during drilling due to hook loads that are also a function of tubular weight and dynamic running conditions. Project staff must determine the maximum amount of compression acting on a derrick leg to choose the required derrick capacity.

• Axial stress is an important input to correct tubular ratings for collapse and burst.

• The use of lighter pipe, with consequently less axial stress, allows for larger diameter drillstrings to be selected, reducing parasitic pressure losses and providing greater hydraulic horsepower to the BHA components and bit.

• The fatigue failure of drill pipe resulting from rotating tubulars in doglegs or under buckling conditions for extended periods under stress is proportional to the axial stress magnitude and type.

The design of lightweight aluminum-based drill pipe (LADP), drilling practices, and analytical studies have shown that LADP strings have technical and technological benefits when compared with steel strings. LADP may reduce the cost of extended reach drill-

Based on and updated from two presentations: IADC/SPE Asia Pacific Drilling Technology Conf., Jakarta, Sept. 7-9, 1998 (IADC/SPE 47823-MS) and SPE Asia Pacific Oil & Gas Conf. and Exhibition, Perth, Oct. 12-14, 1998 (SPE 49957).

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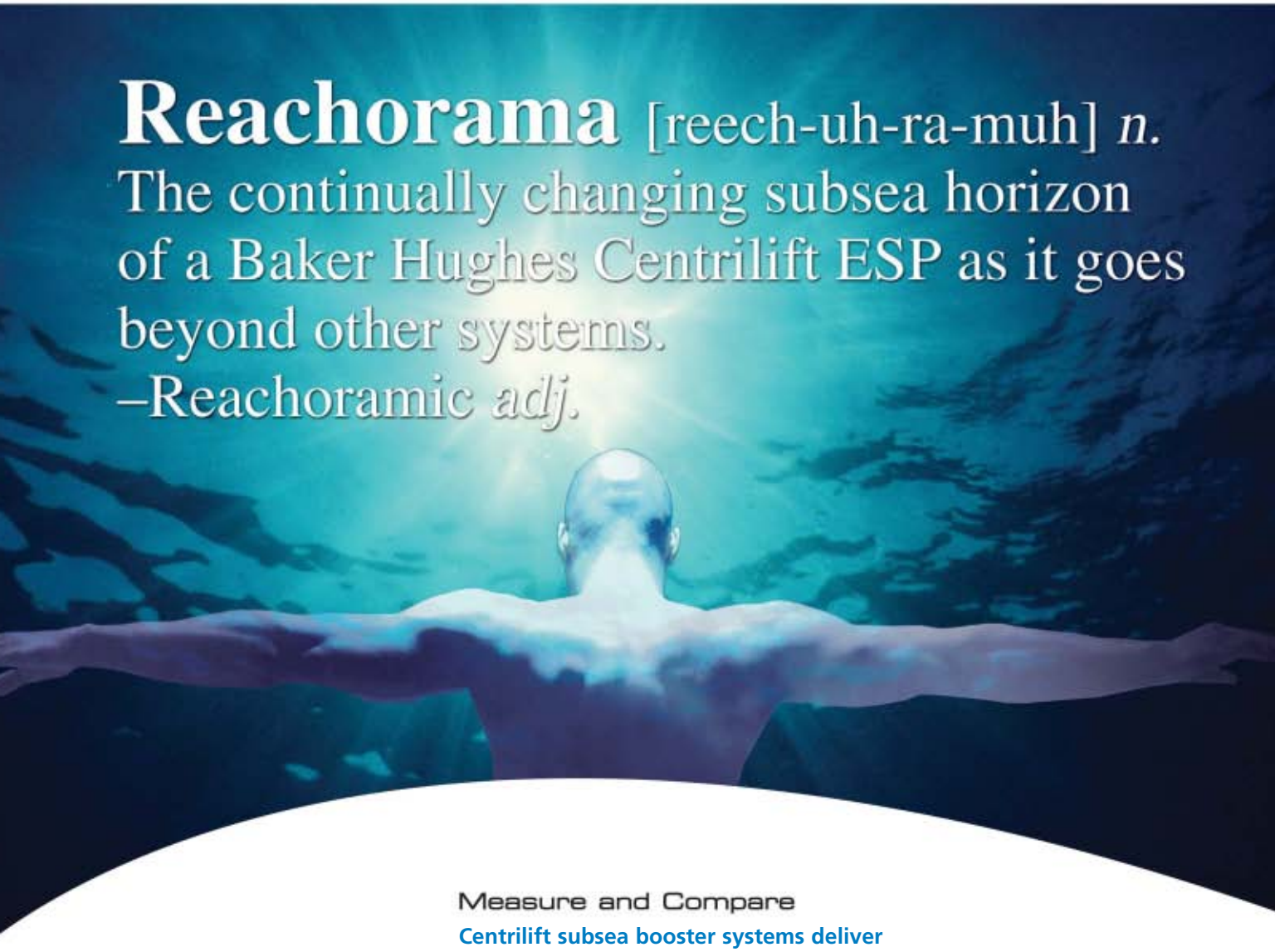

EQUATIONS

$$F_{EDL} = \frac{(n+4)}{n} \times F_{HL} \quad (1)$$

$$\sigma_{vM} = 0.5\sqrt{(\sigma_a + \sigma_b - \sigma_t)^2 + (\sigma_a + \sigma_b - \sigma_i)^2 + (\sigma_r - \sigma_t)^2 + 6(\tau_a^2 + \tau_r^2 + \tau_t^2)} \quad (2)$$

$$\sigma_b = \frac{1{,}308 \times d_o \times L_{B2J} \times \sqrt{\frac{F_a}{EI}}}{\tanh\left[6L\sqrt{\frac{F_a}{EI}}\right]} \quad (3)$$

$$\sigma_a = \frac{4 \times F_a}{\pi(d_o^2 - d_i^2)} \quad (4)$$

$$\sigma_r = \frac{d_i^2 \times P_i - d_o^2 \times P_o - \left[\frac{d_i^2 \times d_o^2}{d_R^2} \times (P_i - P_o)\right]}{(d_o^2 - d_i^2)} \quad (5)$$

$$\sigma_t = \frac{d_i^2 \times P_i - d_o^2 \times P_o + \left[\frac{d_i^2 \times d_o^2}{d_R^2} \times (P_i - P_o)\right]}{(d_o^2 - d_i^2)} \quad (6)$$

$$\tau_a = \frac{4 \times F_a}{\pi \times (d_o^2 - d_i^2)} \times \sin\left(\frac{L_{B2J}}{2}\right) \quad (7)$$

$$\tau_r \cong 0 \quad (8)$$

$$\tau_a = 6d_i \frac{T}{\frac{\pi}{32} \times (d_o^4 - d_i^4)} \quad (9)$$

Hoo s La

$$\sigma = E \times \varepsilon \text{ or} \quad (10)$$

$$\frac{F_a}{\frac{\pi}{4}(d_o^2 - d_i^2)} = E\frac{\Delta L}{L} \quad (11)$$

$$\Delta L = \frac{F_a}{\frac{\pi}{4}(d_o^2 - d_i^2)} \times \frac{L}{E} \quad (12)$$

$$P_B = 0.875 \times \left(\sigma_{YPa} \times \frac{2t}{d_o}\right) \quad (13)$$

$$\sigma_{YPa} = \sigma_Y \times \left[\sqrt{1 - \frac{3}{4} \times \left(\frac{\sigma_a}{\sigma_Y}\right)^2} + \frac{1}{2} \times \frac{\sigma_a}{\sigma_y}\right] \quad (14)$$

$$P_C = 2\sigma_{YPa} \frac{\frac{d_o}{t} - 1}{\left(\frac{d_o}{t}\right)^2} \quad (15)$$

$$\sigma_{YPa} = \sigma_Y \times \left[\sqrt{1 - \frac{3}{4} \times \left(\frac{\sigma_a}{\sigma_Y}\right)^2} - \frac{1}{2} \times \frac{\sigma_a}{\sigma_y}\right] \quad (16)$$

$$BF = 1 - \frac{MW}{\rho_M} \quad (17)$$

Nomenclature

n	=	Number of drilling lines
F_{EDL}	=	Equivalent derrick load
F_{HL}	=	Hook load
σ	=	Principal stress
τ	=	Shear stress
d	=	Diameter of pipe
L	=	Length of pipe string
F_a	=	Axial force (hanging weight)
E	=	Modulus of elasticity
I	=	Cross-sectional moment of inertia
T	=	Tension
BF	=	Buoyancy factor
MW	=	Mud weight
ρ_M	=	Mud density

Subscripts

a	=	axial
b	=	bending
B	=	burst
B2J	=	between two joints
bt	=	bit
C	=	collapse
CBL	=	critical buckling load
EDL	=	equivalent derrick load
ECD	=	equivalent circulating density
HLT	=	hook load and weight of tackle
i	=	inner
m	=	material (steel or aluminum)
o	=	outer
r	=	radial
t	=	tangential
R	=	generic (between inner and outer)
vM	=	von Misses
y	=	yield strength
Ypa	=	adjusted yield points (API 5C3)

ing projects and permit longer displacements.[1]

The objective of this study is to investigate the changes in magnitude of axial stress when aluminum or steel tubulars are used in the drilling process.

It shows the advantages and disadvantages of using aluminum-based composite materials by comparing the results of stress and strength requirements of aluminum and steel-based materials in different drilling aspects, such as derrick loads, bending loads, buckling loads, stress and strain, and hydraulics.

Derrick loads

The derrick supports the weight of drillstring, casing strings, drilling lines, blocks, and tackle. The sum of all these loads is the derrick load. Total derrick load is not shared equally by each leg. One leg (with the dead line anchor attached) will always support more of the total load than the three others. Conservatively, the equivalent derrick load, equivalent to four times maximum leg load, generally determines the required minimum derrick capacity.

Equivalent derrick load depends on hook load and the number of drilling lines. It can be calculated with Equation 1.[2]

For comparison, we determined the equivalent derrick loads for aluminum and steel drillstrings (Table 1). The table shows that equivalent derrick loads can be reduced 65% if aluminum is used for drill and casing strings instead of steel in an 8,200 ft well.

Bending stresses—yield

Hole curvature is a significant wellbore parameter that contributes to drill pipe failures in deviated boreholes. There are two types of drill pipe failure

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in curved holes: yield and fatigue. Yield occurs as soon as von Misses stress[3] exceeds the yield strength of pipe. It can occur even in static conditions. To avoid this type of failure, engineers make sure the maximum anticipated von Misses stress is less than the yield strength of every tubular.

Equation 2 is based on the maximum strain energy of distortion and this equation can be used to determine von Misses stress.[3]

Bending stress is at a maximum at the outer surface of pipes, as shown by Equation 3.[4 5] As we see from Equation 3, bending stress is a function of the hanging weight and the modulus of elasticity, E.

Table 2 provides details of a sample problem that illustrates the difference in bending stresses in aluminum and steel strings. In this example, a dogleg at the top of the hole has a severity of 7.5°/100 ft. The data show that bending stresses are similar for both strings. This is because the reduction in axial force in aluminum strings is offset by the reduction in modulus of elasticity.

Experience has shown that as much as 60% of the hook load comes from drag forces, primarily related to the weight of the drillstring. As the weight of drillstring decreases, so does the drag force. This will influence bending stresses as well. One can expect much smaller bending stresses during trips with aluminum drillstrings due to much smaller drag forces on aluminum, or smaller F_a in the previous equation.

Similar to bending stress, axial stress and axial shear stress are also weight-dependent parameters. Equations 4-9 are used to determine these two stresses.

Table 3 shows another example that illustrates the difference in aluminum and steel strings based on von Misses stresses. In this instance, note that the required minimum yield strength of drill pipe in a steel drillstring is 55,259 psi, whereas the yield required for aluminum is only 36,519 psi.

Fatigue failure

Another consequence of borehole curvature is fatigue failure that shows up under dynamic conditions when pipes are rotating. Fatigue failures can even occur in boreholes in which the von Misses stress is less than the pipe yield strength. It is a time-dependent phenomenon.

Two borehole parameters—dogleg severity and tension—play important roles in determining fatigue life of drill pipe. Fatigue life shortens as the dogleg severity and tension increase. Using aluminum pipe in drillstrings reduces tension considerably and it's reasonable to predict a longer string fatigue life.

Buckling loads

Drillstrings buckle when compression exceeds critical buckling load. Critical buckling load is defined as the load at which tubulars have no resistance against lateral displacement. Even though lateral displacement of pipe during the initial stages of buckling is terminated by the clearance between the wellbore and pipe, some researchers believe this initial buckling, usually 2D, is followed by 3D helical buckling.[6] Therefore, compression should be kept below the critical buckling load.

In order to determine critical buckling loads of aluminum and steel pipes, researchers studied 2D, non-linear buckling using finite-element analysis (Table 4).[6] Predictably, steel pipe can handle twice as much compression as aluminum without initiating buckling.

Stress, strain

The relation between stress and strain is expressed by Hooke's law, shown in Equations 10-12.

One might expect larger stretch in aluminum strings as compared with steel pipe. However, because aluminum strings weigh less, their stretch will not be as large as expected. Table 5 illustrates that both aluminum and steel materials stretch close to the same amount for a given pipe length.

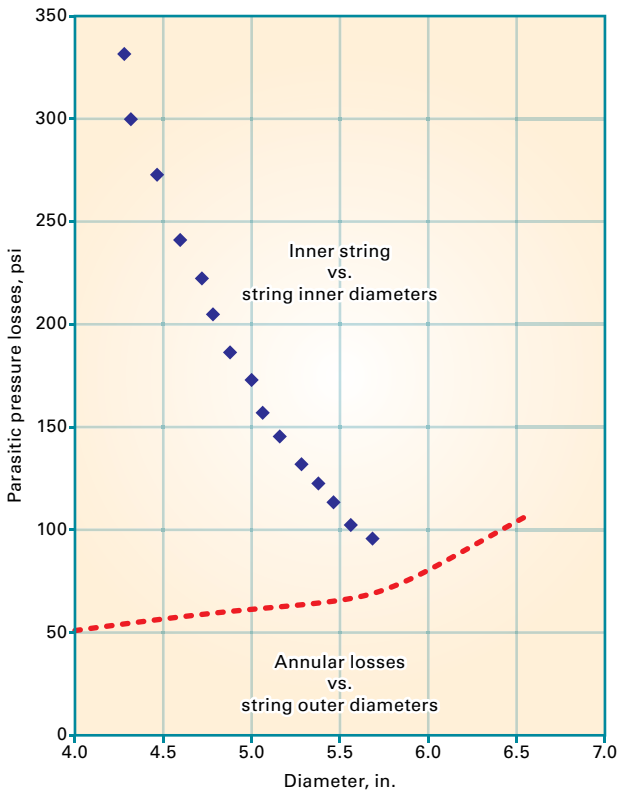
Frictional pressure losses

Parasitic pressure losses in downhole tubulars due to fluid flow depend on five main parameters: pipe length, diameter, flow rate, density, and viscosity. With all other parameters constant, pressure losses can be determined as a function of pipe diameter. Fig. 1 illustrates pressure losses vs. OD of pipe using the data from Table 6.

With the rest of the parameters held

DRILLSTRING, ANNULAR PRESSURE LOSSES

Fig. 1



Equivalent derrick loads

Table 1

String size L: 8,200 ft d_{bt}: 12 in.	Drill pipe d_o: 5 in. d_i: 4.276 in.	Casing d_o: 7 in. d_i: 6.276 in.
	lb	
Steel	196,208	280,817
Aluminum	67,999	97,321

Bending stresses

Table 2

String size L: 8,200 ft α: 0.075°/ft	Drill pipe d_o: 5 in. d_i: 4.276 in.	Casing d_o: 7 in. d_i: 6.276 in.
	psi	
Steel	27,352	27,232
Aluminum	26,846	26,767

Von misses stresses

Table 3

d_o: 5 in. d_i: 4.276 in. L: 8,200 ft α: 0.075°/ft	Steel drill-string	Aluminum drill-string
Pipe weight, lb/ft	17.95	6.219
F_a, lb/ft	147,156	50,996
σ_a, psi	27,352	9,669
σ_r, psi	0	0
σ_t, psi	0	0
σ_b, psi	36,373	26,846
τ_a, psi	548	190
τ_t, psi	0	0
τ_r, psi	0	0
σ_{vM}, psi	55,259	36,519

Critical buckling loads

Table 4

d_o: 5 in. d_i: 4.276 in. L: 8.5 ft α: 0.01°/ft	Steel drill-string	Aluminum drill-string
Pipe weight, lb/ft	17.95	6.219
E, psi	30,000,000	10,880,000
μ	0.3	0.33
F_{CBL}, lb	1,071	508

Elongation

Table 5

Drillstring stretch L: 8,200 ft	Drill pipe d_o: 5 in. d_i: 4.276 in.	Casing d_o: 7 in. d_i: 6.276 in.
	in.	
Steel	91.5	91.5
Aluminum	88.1	88.1

Mud properties, flow data

Table 6

Symbol	Unit	Value
ρ	ppg	11
PV	cp	43
Yp	lb/100 sq ft	20
L	ft	8,200
d_{pt}	in.	10.5
Q	gpm	300

Internal yield strength

Table 7

	E-75 drill pipe d_o: 5 in. d_i: 4.276 in.	N-80 casing d_o: 7 in. d_i: 6.276 in.
	psi	
Steel	7,917	7,328
Aluminum	9,661	5,655

Collapse strength

Table 8

Steel casing (d_o: 7 in., d_i: 5.92 in.)				Aluminum casing (d_o: 7 in., d_i: 5.92 in.)			
37.29 lb-ft	Grade	Eqn.	P_c, psi	12.92 lb-ft	σ_y psi	Eqn.	P_c, psi
	P-110	Plastic	13,244		69,618	Yield	9,152
	C-95	Yield	11,949				
	C-90	Yield	11,225				
	N-80	Yield	9,773				
	C-75	Yield	9,044				

constant, pressure losses increase as outer diameter increases. This is simply because of decrease in hole-pipe clearance.

To produce the data necessary to generate Fig. 1, we determined the pressure losses for pipe with outer diameters from 5 in. to 6.5 in., in 0.1-in. increments. We see that the annular pressure drop increases to 105 psi from 51 psi.

Fig. 1 also illustrates pressure losses for different internal pipe diameters. Contrary to the previous case, as the internal diameter increases, pressure losses decreases. This can be attributed to smaller Reynolds numbers at larger diameters.

In this example, increasing the internal diameter to 5.776 in. from 4.276 in. caused a reduction in pressure loss to 88 psi from 332 psi.

An important observation here is that the overall effect of increasing pipe inner and outer diameters is a decrease in cumulative pressure loss. In this case, overall pressure drop was 190 psi (about 42%).

Tubular sizes are generally specified after examining stress loads, derrick load capacity, and drilling fluid hydraulics. As mentioned above, using aluminum tubulars in place of steel can significantly reduce derrick loads and tubular stresses. This allows the use of larger diameter pipes that will have lower parasitic pressure losses and satisfy the required hydraulics with a smaller slush pump.

Pressure loading

Any analysis of pressure loading on pipe must consider internal yield pressure, collapse pressure (Lame's equation), and plastic collapse pressure.

Internal yield pressure is the magnitude of internal pressure that leads to the internal yield failure (burst) of a pipe under axial stress, calculated with Equations 13-14.

Table 7 shows the differences in internal yield pressure of aluminum and steel pipes. Aluminum and steel pipes have different adjusted yield strengths. For this case, the yield strength of N-80 steel casing is considered to be 80,000 psi and the strength of aluminum-based alloy is 69,618 psi. The yield strength value of E-75 steel drill pipe is considered to be 75,000 psi.

Collapse pressure-API Bulletin 5C3 recommends four equations for computing the collapse pressure resistance of tubulars.[7] The choice of equations is based only on the inside diameter to wall thickness (D/t) ratio of the tubular. The first equation is a theoretical equation based on the yielding of the inner wall of a tubular. It is known as Lame's equation in the mechanics of materials.[3]

The second equation is empirical, derived from collapsing 2,488 tubes of three different grades: K-55, N-80, and P-110. API calls these values the "plastic collapse pressure" of tubes.

The third equation is an arbitrary equation generated by associating the plastic collapse equation with the elastic collapse. It holds no theoretical or empirical substance.

The last equation, Equation 15, is

a theoretical equation based on the bifurcation of the wall of the tubular without yielding. Equation 15 includes the parameter σYPa, defined in Equation 16. In the example, we chose casing dimensions that allowed us to use the elastic collapse equation, as there is no empirical collapse equation for aluminum tubulars at this point.

Table 8 shows that an aluminum casing segment in suspension, with 8,200 ft of casing hanging from it, can resist up to 9,152 psi collapse pressure. Therefore, using aluminum casing in this hole is more favorable than using C-75 steel, as steel casing can only support 9,044 psi.

Buoyancy

The buoyancy factor of drillstring in mud is determined with Equation 17.

The buoyancy factor of aluminum drill pipe plunged into 10 ppg mud is 0.57, while the buoyancy factor of steel pipe in the same mud is 0.85. This is a positive attribute of aluminum; the weight of aluminum drillstring in 10 ppg mud is barely more than half of what it weighs in air.

Aluminum advantage

Using aluminum-based alloys in drillstring can reduce the need for more expensive, stronger drilling components for two main reasons:

1. Lighter drillstring decreases the maximum anticipated stresses, such as the axial stress acting on casing and-or drillstrings, hook load acting on drilling lines, derrick loads acting on derrick legs, and bending stresses acting on downhole tubulars.

2. The collapse strength of aluminum-based drillstrings is higher than that of steel strings. This is because collapse strength of casing is a function of the tension within them.

Quantitative analyses indicate that aluminum tubulars are superior to steel ones in different design cases. For example, equivalent derrick loads can be reduced 65% by using aluminum drill and casing strings instead of steel ones (Table 1).

Calculating von Misses stress for a curved well showed that the required minimum yield strength for aluminum pipes is 52% less than steel (Table 3). Results of stress and stretch calculations based on Hooke's law proved that aluminum strings do not stretch more than steel strings under their own weight (Table 5). Collapse resistance of casings is determined with Lame's theoretical equations for some d/t ratios. Table 8 shows that with 8,200 ft of casing hanging in the hole, aluminum casing has greater collapse resistance than C-75 steel casing.

As mentioned, by using an aluminum string we can employ tubulars with a larger outer diameter in place of smaller-diameter steel, since derrick loads and tubular stresses can be offset. This allows for lower parasitic pressure losses (Fig. 1).

On the other hand, quantitative analysis indicated that there are some disadvantages to using aluminum pipes. For example, critical buckling load for aluminum pipe is about 50% less than steel pipes (Table 4).

This means aluminum pipe can buckle into a helix more easily than steel pipe. A "lockup" condition may occur more frequently in aluminum tubulars. The internal yield strength of aluminum pipe is slightly less than steel when there is no tension acting on the tubulars (Table 7). We expect that as weight increases, this difference becomes more pronounced as the tension increases the internal yield strength of tubulars.

Results

The design of drilling components utilizes strength and stress material attributes and there are significant differences between aluminum and steel strings. When aluminum strings are substituted for steel, stresses are reduced and strength is increased in a number of drilling designs. For instance:

1. Equivalent derrick loads can be reduced. This means operators can use a smaller rig and smaller diameter drilling line.

2. Drillstring axial and bending stresses are lower due to the smaller buoyancy factor and smaller drag forces for aluminum. This means pipe can be run into higher-angle doglegs more safely.

3. Von Misses stress can be reduced, which suggests fewer axial failures.

4. Aluminum pipe stretch, under its own weight, is less than that of steel.

5. Running larger-diameter aluminum pipe in place of smaller-diameter steel pipe can reduce frictional pressure loss in the wellbore during circulation. This results in a lower equivalent circulating density and requires a smaller pump.

6. Collapse strength of casing can increase as weight decreases.

There are some disadvantages to using aluminum pipes as well. For instance, the burst strength of pipes is reduced as weight decreases, and the critical buckling load in aluminum pipes is less than that of steel pipes. This could be major drawback in extended reach drilling. ✦

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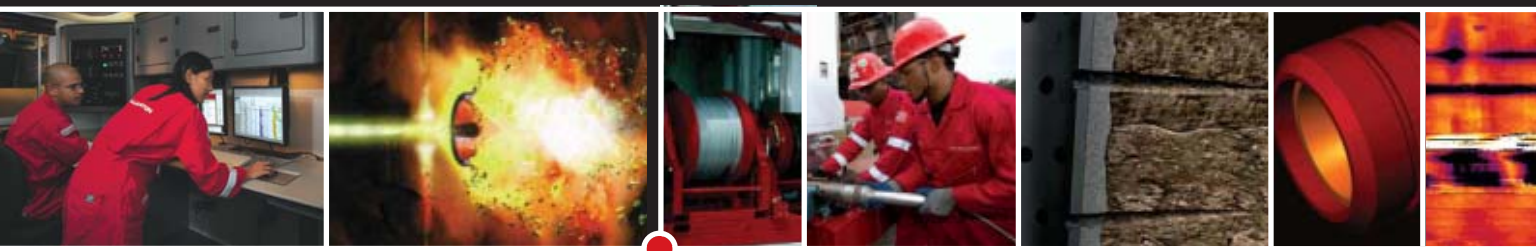

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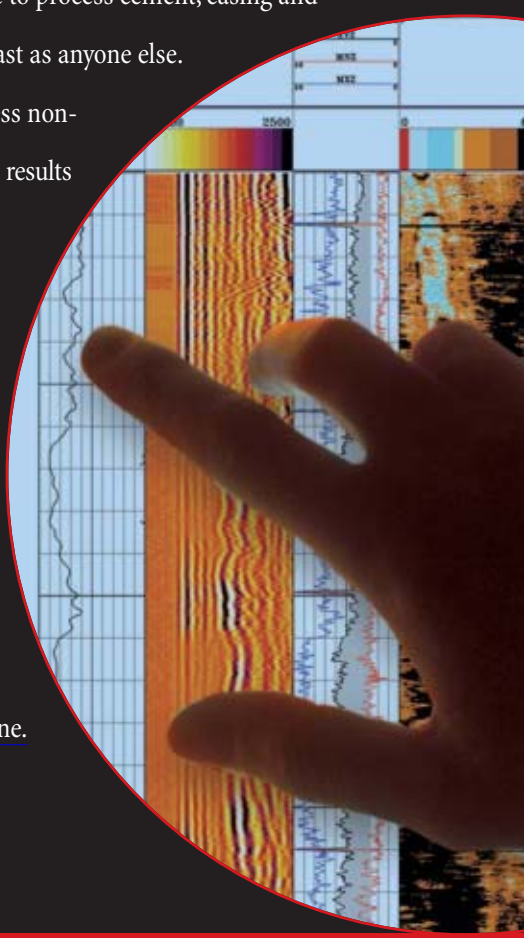

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The authors

Ferda Akgun (fakgun@pi.ac.ae) is an associate professor in the department of petroleum engineering at the Petroleum Institute, Abu Dhabi. He has also served as a faculty member at UAE University, University of New South Wales, and Middle East Technical University. Akgun holds a BS (1982) from Middle East Technical University and a PhD (1989) from Colorado School of Mines, both in petroleum engineering. He is a certified WellCAP and IWCF instructor and a member of SPE.

Eric Maidla (eric.maidla@slidercorp.com) is founder and partner of Slider LLC, which specializes in automated directional drilling technologies. He was vice-president of business development for Noble, 2001-04, and prior to that, worked in Australia for 7 years as the head of the drilling group at CSIRO, an Australian government research organization. In 1988, Maidla founded the petroleum engineering department at the State University of Campinas, Brazil. He holds a BS (1981) in mechanical engineering from Escola de Engenharia Maua, Sao Paulo; an MS (1985) and a PhD (1987), both in petroleum engineering from Louisiana State University, Baton Rouge. Maidla is a member of SPEm has served on the SPE books and managed pressure drilling committees since 2002, and has chaired various conferences and workshops.

Aromatics increase rvp blending value

William Morris
Consultant
Wilmington, Del.

This article describes a procedure to include the effect of aromatics on rvp blending calculations and presents the pertinent data for these calculations. Refiners that account for this aromatics effect can blend slightly more normal butane into the gasoline pool while meeting the same rvp specification.

In refineries, the rvp blending behavior of pressurizing agents is usually based on standard blending values or on linear blending of the rvp index, which typically is rvp to the power of 1.5. The rvp blending values, however, of pressurizing agents increase with the aromatic content of the gasoline.

Effect of aromatics

The results of a comprehensive blending study showed a considerable difference in rvp blending values of normal butane with different gasoline components.[1] Table 1 shows the results of this study.

RVP EFFECT OF NORMAL BUTANE Table 1

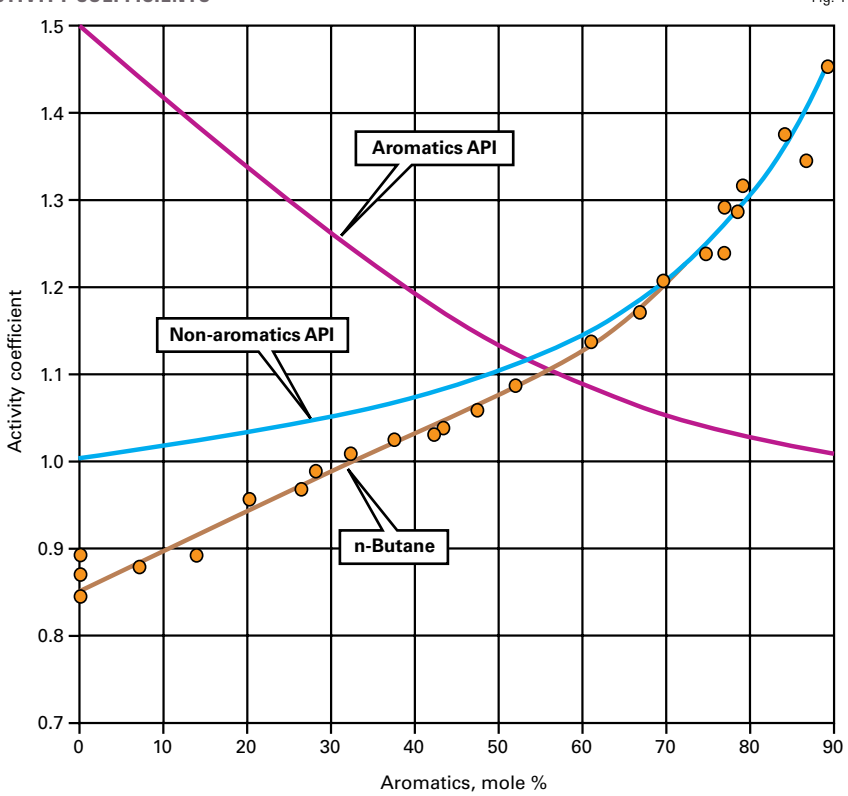
Component	rvp, psi: Component	rvp, psi: 90% component + 10% normal butane	rvp, psi: Difference	Blending value
Cat cracked gasoline	4.8	10.6	5.8	63
Reformate A	2.1	8.3	6.2	64
Reformate B	1.0	7.5	6.5	66
Raffinate	2.3	8.0	5.7	59
Alkylate	9.1	14.2	5.1	60
Straight-run gasoline	7.9	12.5	4.6	54

Source: Reference 1

The blending value range of 54-66 psi is much greater than errors of 2-3 psi that could be expected with the old rvp test.

The highest blending values were in the two reformate components. This is consistent with the well-known non-

ACTIVITY COEFFICIENTS Fig. 1



Hydrocarbon activity coefficients

Table 2

Hydrocarbon	Activity coefficient
Ethane[1]	0.74
Propene[1]	0.74
Propane[1]	0.74
Isobutane	0.75 + 0.0154 × % aromatics
n-Butane	0.85 + 0.0045 × % aromatics
trans-2-Butene[2]	0.96 + 0.0032 × % aromatics
cis-2-Butene[2]	0.96 + 0.0032 × % aromatics
Isobutene[2]	0.96 + 0.0032 × % aromatics
Aromatics	1.50 – 0.0081 × % aromatics
Nonaromatics[3]	1.00 + 0.0016 × % aromatics

[1]0.74 for propane at 20% aromatics. Effect of aromatic content not determined. Ethane and propene assumed the same as propane. [2]Data for trans-2-butene assumed to apply to the other two olefins. [3]Isopentane and higher-boiling hydrocarbons behave as typical nonaromatics.

ideal blending behavior of nonaromatics with aromatics.[2]

Luskin and Morris developed a chemical engineering model of the rvp test based on molar blending, accounting for the vapor space in the rvp test and coefficients to correct for nonideal blending.[3] The model predicted the rvp of 10 pure hydrocarbon blends of paraffins, olefins, and naphthenes with a standard error of 0.15 psi, using an activity coefficient of 1.0 (ideal solution behavior).

For 18 blends of aromatics with nonaromatics, incorrectly assuming ideal behavior led to an underprediction of rvp of as much as 3.1 psi. Given appropriate activity coefficients, the standard error was only 0.15 psi.

The effects of aromatics on the activity coefficients of normal butane and isobutane are larger than the effects for other nonaromatics. The effects are based on activity coefficients estimated by back-calculation, the chemical engineering model of the rvp test, and data obtained on blends with up to 40% aromatics.

The previously unpublished results in Table 2 show that isobutane is the most responsive to aromatics. Its rvp blending value increases about 1 psi for each percent increase in aromatic content. It is important to minimize the isobutane content of gasoline, and this is particularly true for the higher-aromatic grades.

Table 3 shows the data used to develop the activity coefficient relationship with aromatic content for normal butane. Fig. 1 shows the activity coefficient curve.

Application

To apply the activity coefficients and the chemical engineering model, we use the BLENRVP program[4] to calculate rvp for appropriate blends. The BLENDRVP program uses the rvp results to obtain interaction blending equations, which can be applied in the same way as octane and ASTM distillation interaction equations.

We used pressurizing agent gas chromatograph composition data for 13 different constituents including those that will be present only in trace amounts.

Table 4 lists the constituents and typical octane and rvp blending values.

Refiners can use these data to estimate blending effects of pressurizing agents, but they can obtain better rvp results when accounting for the aromatic content of the gasoline being blended.

Exploiting aromatic effects

Maximizing the use of normal butane in low-aromatic gasoline grades will minimize its rvp blending value, resulting in a slight increase in gasoline volume. Because of other factors present when refiners optimize the compositions of different gasoline grades, this effect will be small, perhaps up to 0.1%.

This upgrading of normal butane over time, however, can become quite profitable.

Normal butane, activity vs. aromatics

Table 3

Mixture	Composition, vol %	Aromatics, mole %	rvp	Calculated activity coefficient
Iso-octane, n-butane	90/10	0	7.84	0.845
	85/15	0	10.7	0.843
n-Heptane, n-butane	90/10	0	7.50	0.890
n-Hexane, n-butane	90/10	0	9.79	0.869
Iso-octane, toluene, n-butane	85/5/10	7.1	7.91	0.876
	80/10/10	13.9	7.84	0.890
	75/15/10	20.3	8.10	0.953
	70/20/10	26.4	8.00	0.964
	65/25/10	32.3	8.09	1.005
	55/35/10	43.2	7.91	1.033
	50/35/15	42.1	10.9	1.028
	40/45/15	51.9	10.9	1.084
	30/55/15	61.0	10.9	1.136
	20/65/15	69.3	11.0	1.204
n-Hexane, pseudocumene, n-butane	60/30/10	28.1	9.30	0.984
	50/40/10	37.6	9.10	1.021
	40/50/10	47.3	8.87	1.056
	30/60/10	57.0	8.71	1.102
	20/70/10	66.8	8.64	1.170
	10/80/10	76.7	8.51	1.237
Pseudocumene, n-butane	80/20	74.4	15.4	1.238
	90/10	86.8	8.55	1.344
Toluene, pseudocumene, n-butane	40/40/20	76.9	15.0	1.290
Toluene, m-xylene, n-butane	40/40/20	78.2	14.1	1.283
Toluene, n-butane	80/20	79.0	14.3	1.315
	85/15	84.2	11.4	1.374
	90/10	89.4	8.30	1.453

Typical blending values

Table 4

Component	rvp, psi	Blending values rvp	RON	MON
Ethane	730	474	110	101
Propene	226.4	216	102	85
Propane	190.0	173	112	97
Isobutane	72.20	91.1	107	96
Isobutene	63.40	82.3	136	97
Butene-1	63.05	82.0	118	86
n-Butane	51.60	59.6	94	89
trans-2-Butene	49.80	67.0	107	88
cis-2-Butene	45.54	63.3	108	87
Isopentane	20.44	22.7	91	87
n-Pentane	15.57	17.6	60	66
C_5 olefins	16.46	18.5	111	86
C_{6+}	6.77	6.9	73	76

Note: C_5 olefins in FCC proportion. C_{6+} data for 2-methylpentane.

Acknowledgment

This article is based mainly on work

done by Michael M. Luskin at the DuPont Co. Petroleum Laboratory. ✦

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The author

William E. Morris is a consultant in Wilmington, Del., who provides gasoline blending computer programs via his web site, www.gasolineblendingplus.com. He worked for ExxonMobil Corp.'s Bayway, NJ, refinery for 7 years. Then he joined the DuPont Co. petroleum laboratory where he provided technical service for refineries in support of petroleum chemical sales. Morris holds a BS in chemical engineering from the University of Missouri.

Nelson-Farrar cost indexes

Refinery construction (1946 Basis)

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

	1962	1980	2004	2005	2006	Nov. 2006	Oct. 2007	Nov. 2007
Pumps, compressors, etc.	222.5	777.3	1,581.5	1,685.5	1,758.2	1,787.0	1,861.6	1,862.6
Electrical machinery	189.5	394.7	516.9	513.6	520.2	527.3	514.1	511.9
Internal-comb. engines	183.4	512.6	919.4	931.1	959.7	963.8	977.7	977.7
Instruments	214.8	587.3	1,087.6	1,108.0	1,166.0	1,220.4	1,283.5	1,281.4
Heat exchangers	183.6	618.7	863.8	1,072.3	1,162.7	1,179.4	1,374.7	1,374.7
Misc. equip. average	198.8	578.1	993.8	1,062.1	1,113.3	1,135.6	1,202.3	1,201.6
Materials component	205.9	629.2	1,112.7	1,179.8	1,273.5	1,295.7	1,350.6	1,356.9
Labor component	258.8	951.9	2,314.2	2,411.6	2,497.8	2,550.0	2,645.8	2,661.3
Refinery (Inflation) Index	237.6	822.8	1,833.6	1,918.8	2,008.1	2,048.3	2,127.7	2,139.5

Refinery operating (1956 Basis)

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

	1962	1980	2004	2005	2006	Nov. 2006	Oct. 2007	Nov. 2007
Fuel cost	100.9	810.5	971.9	1,360.2	1,569.0	1,473.1	1,374.7	1,647.5
Labor cost	93.9	200.5	191.8	201.9	204.2	213.1	201.4	230.5
Wages	123.9	439.9	984.0	1,007.4	1,015.4	1,072.0	958.6	1,106.9
Productivity	131.8	226.3	513.3	501.1	497.5	503.1	476.1	480.3
Invest., maint., etc.	121.7	324.8	686.7	716.0	743.7	758.6	785.1	789.5
Chemical costs	96.7	229.2	268.2	310.5	365.4	363.2	392.5	415.1
Operating indexes								
Refinery	103.7	312.7	486.7	542.1	579.0	580.0	581.0	620.6
*Process units**	103.6	457.5	638.1	787.2	870.7	845.0	816.4	922.1

**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.

Chemicals improve compressed-air European crude line cleaning

Peter Verkiel
Brenntag Nederland BV
Dordrecht, the Netherlands

Proper chemicals allow safe and economical cleaning and emptying of a large crude line using compressed air, rendering the line hydrocarbon free with a lower explosion level for the air inside the line of 0%.

Brenntag Oil & Gas Europe cleaned a 140-km, 24 in. OD crude transport line for the Total refinery in Vlissingen, Netherlands, using N-SPEC cleaning chemicals. Brenntag applied compressed air as a propelling agent to transport pigs through the pipeline, a technique rarely used in Europe due to the relatively high risks. Brenntag, however, succeeded in removing all hydrocarbons from the pipeline, bringing the LEL down to a unique 0%.

DISPERSANT, TYPICAL PHYSICAL PROPERTIES Table 1

Appearance	Liquid, mild scent, clear amber
Specific gravity, 20° C.	0.87
Flash point, °C.	>300
Pour point, °C.	–6
pH	n/a
Solubility	Oil soluble
Sulfur, %	<0.01

MULTIPURPOSE CLEANER, TYPICAL PHYSICAL PROPERTIES Table 2

Appearance	Liquid, lemon scent, clear dark blue
Specific gravity, 20° C.	0.95
Flash point, °C.	>200
Pour point, °C.	–9
pH	6-6.5
Solubility	Water soluble, oil dispersible

Background

The crude transport line required modification in two places, and some block valves needed to be overhauled to safeguard its operation. Performing these activities necessitated emptying and cleaning the transport line, ensuring the safety of its internal environment to eliminate danger of explosion during welding and cutting.

The maximum allowed LEL was 10% or less, which had to be achieved with the following additional requirements:

- A time frame of about 5 weeks to complete the project.
- Application of compressed air to transport pigs through the pipeline.
- Minimum waste disposal.
- Specific safety precautions set by the client.

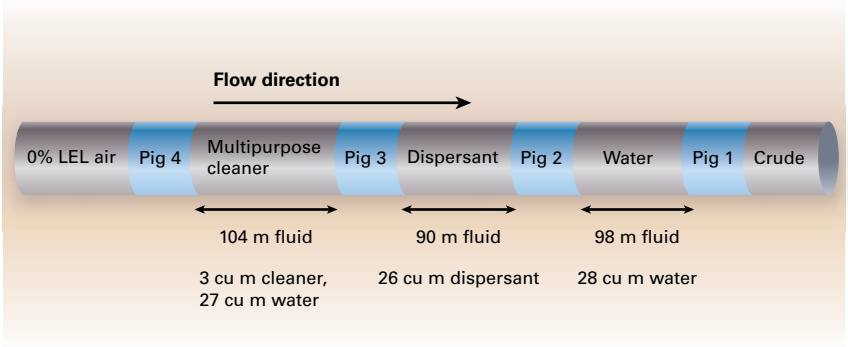
Start-up

Prior to performing the cleaning, Brenntag and Visser & Smit Hanab, the pipeline's main contractor, developed

Precleaning of Total's 140-km crude transport line to its refinery in Vlissingen, the Netherlands, removed the wax and paraffin shown here in a trap at the refinery (Fig. 1).

PIG TRAIN

Fig. 2



a project execution plan, documenting all elements of the project, and a risk inventory and evaluation, analyzing all possible risks and measures to reduce them to a level acceptable to both Brenntag and VSH.

The plan split the project into three phases:

- Phase 1: online precleaning with several pigging runs.
- Phase 2: removal of the crude and offline cleaning of the pipeline in a single pigging run using Brenntag's agent, followed by cutting-welding services.
- Phase 3: refilling the line with crude.

Brenntag used this 24-in. pig launcher at the Maasvlakte Oil Terminal to launch the four-pig train used to clean Total's crude transport line. This picture also shows the chemical units that injected dispersant and cleaning agents between the pigs and the compressor units used to push the train towards the refinery with compressed air (Fig. 3).

Phase 1

The first phase involved precleaning. Lab tests showed a special wax and paraffin dispersant (Table 1), and a multipurpose cleaner (Table 2), would be most effective for this type of contamination and for the total removal of hydrocarbons.

Brenntag carried out the precleaning online to avoid downtime and production losses. Several pig runs removed the first levels of wax and paraffin (Fig. 1). Brenntag monitored all runs, gaining a good indication of the contamination inside the transport line. During the week before the turnaround, Brenntag executed a pig run using 15,000 l. of the dispersant, with the line still in service.

The refinery can process the dispersant as a hydrocarbon without disturbing downstream processes as far as experience shows. All removed wax and paraffin, therefore, including the dispersant, continued into the storage tanks at the refinery, allowing the entire precleaning process to take place with both the pipeline and the refinery remaining online.

Phase 2

The second phase of the project involved removal of the crude and all remaining wax, paraffin, and heavy carbons inside the line, a total of 40,000 cu m. After taking the line out of service and depressurizing it, Brenntag established a pig train, consisting of four designated pigs interspersed with a column of the required chemicals and water (Fig. 2). Compressed air acted as a propelling agent, reducing waste disposal and the time required to complete the project. Also, unlike nitrogen, it has no issues with cold temperatures.

Injecting water in the first compartment, in combination with two designated bidirectional sealing pigs, avoided any contact between air and crude, thereby reducing risk. The pigs also lacked metal parts that could contact the inner pipe wall.

Injecting 26 cu m of the dispersant into the second compartment, removed all remaining wax and paraffin. The third bidirectional pig created agitation in this column of fluid, enhancing the dissolving and dispersal of wax and paraffin.

Injecting 3 cu m of Brenntag's multipurpose cleaner, diluted by 27 cu m of water, into the third compartment dispersed all heavy carbons. The fourth pig used the same agitation technique as the third to optimize the chemical's dispersing qualities.

Launching the pigs occurred individually, with the required fluids injected between (Fig. 3). The launch of the first pig took place with water, to avoid any contact between the crude and the compressed air. The first and the fourth pig used transponders, allowing them to be tracked between the Maasvlakte Oil Terminal (Rotterdam) and Vlissingen. The complete pig train launch used five compressors at a pressure of 10 bar and the train traveled at 0.94 m/sec.

The total journey took 41 hr and 25 min, yielding a chemical-deposition contact time calculated to be effective.

The water also cleaned all chambers of the block valves, which were thoroughly flushed as the chemicals did their work.

At the Vlissingen receiving site Brenntag created a steel dump line from the receiver to a temporary knockout vessel connected to containers. Equipping the pigs with transponders allowed the velocity of the pig train to be reduced to about 0.5 m/sec near the refinery. The first pig, including the column of water, followed the normal flow direction into Total's storage tanks during collection. Arrival of the second pig triggered a closing of the normal flow direction, with a temporary dump line opened to collect the rest of the fluids and debris via the knockout vessel into the storage containers. Receipt of the third and fourth pig followed the same pattern.

The conclusion of pig collection required a second line depressurization. A knockout vessel equipped with a 20-in. demister accomplished the bulk of depressurization over 6 hr.

Marsac measured the LEL of the outflowing air during depressurization at three sites, finding 0% LEL at each of them:

- The launching site at MOT in Rotterdam.
- The receiving site in Vlissingen.
- Block valve station S3.

This safe inside-line environment helped VSH perform required cutting and welding activities within the budgeted time-frame without any spillage or emission to the environment.

Phase 3

Restart of the line following cleaning required refilling it with crude from the MOT in Rotterdam to Total's refinery in Vlissingen. Two bidirectional separation pigs interspersed by a column of water of about 24 cu m helped accomplish refill, again using the demister. All out-coming air entered the environment without spray. The internal LEL remained 0%. ✦

The author

Peter Verkiel (pverkiel@brenntagoil&gas.com) is European product manager for N-SPEC products and services at Brenntag Oil & Gas Europe, in Dordrecht, the Netherlands. He has also served as pipeline and construction engineer at Shell-NAM and as area manager at A. Hak. He holds a degree in mechanical engineering.

All-metal progressing cavity pump handles hot fluids

Here's the Vulcain progressing cavity pump, a new product with an all-metal design that is capable of pumping hot (as high as 660° F.) and viscous fluids. It's suited for use in thermal recovery of heavy oil.

The company says that the rotary action of its pump outperforms beam pumps in overall system efficiency and is less fragile than electric submersible pumps. The pump provides low submergence production capability and can operate at low downhole pressures and higher viscosities.

The pump's seals reduce the risk of onsite leakage, and the compact installation footprint reduces its visual impact on the landscape, the firm notes.

Source: **PCM,** 17 rue Ernest Laval, 92170 Vanves, France.

New shaft seal pumps lubricant back to bearing

New low-friction Waveseal shaft-sealing solutions feature a specially molded lip to form a sinusoidal or wave pattern around the shaft surface.

Seals enable lubricant to be pumped back to bearings and protect against contaminants in applications including gearboxes, motors, transmissions, drive systems, speed reducers, and pumps.

This pattern enables lubricant to be pumped back to the bearing for optimized lubricant retention while pushing dirt away from the lip-shaft surface (regardless of which way the shaft is turning) to protect against contamination.

The specially designed lip additionally generates 25-35% less heat at the contact point (minimizing premature seal failure due to heat checking, blistering, hardening, or lubricant breakdown); generates 20% less friction torque or drag; curbs shaft wear; and provides greater lip lubrication compared with standard lip versions, the firm says.

Source: **SKF USA Inc.,** 1510 Gehman Rd., Kulpsville, PA 19443.

MESA Products Inc.


Hall

Tulsa, has appointed Charles L. Hall as director, business development. He will be responsible for business development for the construction, engineering, technical services, and materials groups. Hall has more than 30 years experience in the pipeline industry at both operator and service company levels. He is active in the corrosion community, serving on several NACE technical committees. In addition, MESA has named Marty Fourkiller manager of technical service for MESA Corrosion in the North Texas area. In 2007, he became district manager of the newly opened MESA Dallas-Fort Worth office. Fourkiller has an associate's degree in drafting and design from Oklahoma State University-Okmulgee and was employed as a corrosion technician in the oil and gas industry through 1989 before developing his own business as a independent-contractor corrosion technician in 1990. He joined MESA Products in 2004. Fourkiller, a member of NACE International since 1984, also serves as secretary for the Dallas-Forth Worth NACE section.


Fourkiller

MESA Products provides engineering, installation, and materials for cathodic protection systems for a wide variety of applications in the oil and gas industry.

Industrial Scientific Corp.


McElhattan

Pittsburgh, has elected Justin McElhattan to the newly created position of president and COO. He will be responsible for integrating and growing the corporation's worldwide gas monitoring business. Since joining Industrial Scientific in 1998, McElhattan has served as North America sales manager, general manager of service operations, director of global operations, vice-president of operations, and president of Industrial Scientific Americas. He holds a BS from Penn State University and an MBA from Carnegie Mellon University.

Industrial Scientific provides gas detection and monitoring equipment worldwide.

Paradigm BV

Amsterdam, has appointed James Lamb as U.S. regional vice-president and Serge Sauvagnac as vice-president, business development-premier partners. Previously, Lamb was vice-president of business development leading the premium partners program and regional vice-president of Paradigm's Canada region. He holds a BS in geophysics from the University of Canada and has more than 16 years of experience in the E&P industry. Sauvagnac previously was global account manager and country manager of Paradigm Indonesia. With more than 17 years of experience in E&P global account management, he has a BS in computer science and a master's in hydrogeology from the Paris School of Mines

Paradigm provides enterprise software solutions to the global oil and natural gas exploration and production industry.

Knight


Ramm

Lafayette, La., has appointed Gaylen Ramm corporate sales representative focused on fishing services and rental tools. He will be based in Knight's Houston office and represent the sales force throughout the Houston area. Previously, Ramm worked in corporate sales for Key Energy Services. He has undergraduate and master's degrees from Stephen F. Austin State University.

Knight's operating units include Knight Oil Tools, Knight Fishing Services, Knight Well Services, and Knight Manufacturing. The company is the largest privately held rental tool business in the oil and gas industry.

Expro International Group PLC

Reading, UK, has signed a letter of intent with Aker Oilfield Services Ltd., Oslo, to jointly market Expro's proprietary AX-S rigless intervention technology together with Aker's fleet of well intervention vessels. The goal would be to develop a global alliance to procure the two firms' combined capabilities in a seamless, integrated manner. Aker is investing in a fleet of state-of-the-art subsea intervention vessels due for delivery beginning in 2009.

Expro is a market leader in well flow management services and products. Aker Oilfield Services offers fully integrated subsea and well intervention services from its fleet of monohull well intervention units.

SulphCo Inc.

Houston, has appointed M. Clay Chambers COO. He has more than 35 years experience in the refining and petrochemical industry, having worked for UOP Inc., Coastal Corp., El Paso Corp., and Texas City Refining. Chambers has a degree in chemical and petroleum refining engineering from the Colorado School of Mines and an MBA from the University of Houston.

SulphCo provides a process employing ultrasound technology to desulfurize and hydrogenate crude oil and other oil products, thereby helping to upgrade sour, heavy crude oils into sweeter, lighter crude oils.

InterMoor Inc.


Urech

Houston, has named Harry Urech business development manager. He will be responsible for developing and implementing the company's business plans for current and new lines of business, including expanding InterMoor's service offerings. Previously Urech was offshore sales manager for Samson Ropes and was vice-president of sales and marketing for Franklin Offshore Americas.

Meantime, InterMoor has earned two Safe Work Recognition awards for safe practices and no incidents or lost time while performing mooring and anchoring operations on the Transocean Marianas semisubmersible drilling rig in the ultradeepwater US Gulf of Mexico. To date the 243-day work phase has involved 10 InterMoor crews and a total of 99 men, performing mooring installation, hookup, disconnect, and recovery without incident—helping InterMoor to reach an unprecedented 5 years without a lost-time incident.

InterMoor, an Acteon company, is a leading supplier of mooring technology, providing innovative solutions for rig moves and mooring services, including engineering and design, fabrication, and subsea installation.

Imports of crude and products

	Districts 1-4 2-15 2008	Districts 1-4 2-8 2008	District 5 2-15 2008	District 5 2-8 2008	Total US 2-15 2008	Total US 2-8 2008	Total US *2-16 2007
	1,000 b/d						
Total motor gasoline	827	841	—	—	827	841	948
Mo. gas. blending comp.	394	453	—	—	394	453	437
Distillate	381	282	—	—	381	282	334
Residual	404	200	—	—	404	200	369
Jet fuel-kerosine	71	103	—	54	71	157	221
Propane-propylene	174	139	26	21	200	160	107
Other	1,233	1,210	60	60	1,293	1,270	924
Total products	**3,484**	**3,228**	**86**	**135**	**3,570**	**3,363**	**3,340**
Total crude	**9,034**	**8,414**	**1,068**	**1,323**	**10,102**	**9,737**	**9,742**
Total imports	**12,518**	**11,642**	**1,154**	**1,458**	**13,672**	**13,100**	**13,082**

*Revised.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Purvin & Gertz LNG netbacks—Feb. 22, 2008

Receiving terminal	Liquefaction plant: Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMbtu					
Barcelona	7.76	5.56	6.89	5.45	6.20	6.80
Everett	8.59	6.21	8.18	6.27	6.87	8.91
Isle of Grain	8.17	5.52	7.53	5.40	6.33	7.50
Lake Charles	6.41	4.22	6.14	4.41	4.72	7.10
Sodegaura	6.67	8.42	6.63	8.43	7.68	5.64
Zeebrugge	7.72	5.60	7.04	5.56	6.22	7.05

Definitions, see OGJ Apr. 9, 2007, p. 57.
Source: Purvin & Gertz Inc.
Data available in OGJ Online Research Center.

Crude and product stocks

District	Crude oil	Motor gasoline: Total	Motor gasoline: Blending comp.[1]	Jet fuel, kerosine	Fuel oils: Distillate	Fuel oils: Residual	Propane-propylene
	1,000 bbl						
PADD 1	14,829	63,884	33,291	9,426	45,141	14,683	3,870
PADD 2	63,130	56,017	19,410	8,466	29,740	1,545	10,667
PADD 3	158,958	69,622	32,848	11,707	30,963	14,849	18,160
PADD 4	12,382	6,960	2,208	525	3,065	410	[1]1,108
PADD 5	55,975	33,781	26,729	9,679	13,618	5,428	—
Feb. 15, 2008	**305,274**	**230,264**	**114,486**	**39,803**	**122.527**	**36,915**	**33,805**
Feb. 8, 2008	**301,070**	**229,236**	**113,555**	**41,093**	**126,973**	**36,893**	**36,813**
Feb. 16, 2007[2]	**327,583**	**222,115**	**98,962**	**39,133**	**128,290**	**38,666**	**34,680**

[1]Includes PADD 5. [2]Revised.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Refinery report—Feb. 15, 2008

District	Refinery operations: Gross inputs	Refinery operations: Crude oil inputs	Refinery output: Total motor gasoline	Refinery output: Jet fuel, kerosine	Refinery output: Fuel oils: Distillate	Refinery output: Fuel oils: Residual	Refinery output: Propane-propylene
	1,000 b/d						
PADD 1	1,175	1,214	1,628	69	387	103	60
PADD 2	3,228	3,199	2,291	214	973	58	213
PADD 3	6,926	6,872	3,116	708	1,887	269	673
PADD 4	536	540	308	23	168	11	[1]134
PADD 5	2,697	2,639	1,497	434	595	169	—
Feb. 15, 2008	**14,562**	**14,464**	**8,840**	**1,448**	**4,010**	**610**	**1,080**
Feb. 8, 2008	**14,834**	**14,561**	**8,909**	**1,441**	**4,091**	**649**	**1,106**
Feb. 16, 2007[2]	**14,828**	**14,420**	**8,640**	**1,398**	**3,839**	**637**	**1,008**
	17,436 operable capacity		**83.5% utilization rate**				

[1]Includes PADD 5. [2]Revised.
Source: US Energy Information Administration
Data available in OGJ Online Research Center.

Additional analysis of market trends is available through **OGJ Online**, *Oil & Gas Journal's* electronic information source, at http://www.ogjonline.com.

OIL&GAS JOURNAL online research center

OGJ crack spread

	*2-22-08	*2-23-07	Change $/bbl	Change, %
SPOT PRICES				
Product value	109.83	72.25	37.58	52.0
Brent crude	98.76	59.17	39.59	66.9
Crack spread	11.07	13.08	–2.01	–15.4
FUTURES MARKET PRICES				
One month				
Product value	110.81	71.86	38.95	54.2
Light sweet crude	99.45	60.06	39.39	65.6
Crack spread	11.36	11.80	–0.44	–3.7
Six month				
Product value	112.04	75.36	36.68	48.7
Light sweet crude	97.41	63.45	33.96	53.5
Crack spread	14.63	11.91	2.72	22.8

*Average for week ending.
Source: Oil & Gas Journal
Data available in OGJ Online Research Center.

OGJ GASOLINE PRICES

	Price ex tax 2-20-08	Pump price* 2-20-08	Pump price 2-21-07
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	271.6	311.3	218.1
Baltimore	255.5	297.4	220.1
Boston	265.4	307.3	218.3
Buffalo	272.0	332.1	240.2
Miami	275.9	326.2	237.8
Newark	259.6	292.5	216.6
New York	247.2	307.3	227.8
Norfolk	252.0	289.6	213.8
Philadelphia	262.5	313.2	242.2
Pittsburgh	258.6	309.3	223.9
Wash., DC	270.9	309.3	228.9
PAD I avg.	262.8	308.7	226.1
Chicago	291.1	342.0	253.2
Cleveland	253.9	300.3	229.2
Des Moines	258.6	299.0	220.2
Detroit	257.0	306.2	230.0
Indianapolis	258.3	303.3	235.1
Kansas City	253.0	289.0	213.6
Louisville	268.3	305.2	232.7
Memphis	250.6	290.4	213.1
Milwaukee	251.3	302.6	232.8
Minn.-St. Paul	256.9	297.3	227.7
Oklahoma City	252.4	287.8	213.0
Omaha	257.4	303.8	224.3
St. Louis	250.2	286.2	219.1
Tulsa	252.3	287.7	210.1
Wichita	245.6	289.0	220.5
PAD II avg.	257.1	299.3	225.0
Albuquerque	263.6	300.0	218.8
Birmingham	260.5	299.2	214.7
Dallas-Fort Worth	253.5	291.9	217.6
Houston	256.8	295.2	212.5
Little Rock	251.7	291.9	216.5
New Orleans	256.9	295.3	219.4
San Antonio	251.2	289.6	208.9
PAD III avg.	256.3	294.7	215.5
Cheyenne	246.9	279.3	208.9
Denver	251.6	292.0	219.9
Salt Lake City	260.3	303.2	217.4
PAD IV avg.	252.9	291.5	215.4
Los Angeles	252.0	310.5	271.3
Phoenix	251.9	289.3	229.6
Portland	259.4	302.7	250.0
San Diego	259.0	317.5	272.5
San Francisco	284.2	342.7	293.7
Seattle	261.3	313.7	260.2
PAD V avg.	261.3	312.7	262.9
Week's avg.	**258.8**	**302.4**	**228.4**
Jan. avg.	**260.9**	**304.5**	**225.3**
Dec. avg.	**257.0**	**300.6**	**228.5**
2008 to date	**259.2**	**302.8**	—
2007 to date	**181.8**	**225.4**	—

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

REFINED PRODUCT PRICES

	2-15-08 ¢/gal		2-15-08 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	246.04	New York Harbor	264.28
Gulf Coast	246.29	Gulf Coast	262.20
Los Angeles	255.54	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	237.39	ARA	274.74
Singapore	250.10	Singapore	264.33
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	242.79	New York Harbor	170.76
Gulf Coast	245.79	Gulf Coast	172.93
Los Angeles	260.54	Los Angeles	179.03
		ARA	188.23
		Singapore	179.23

Source: DOE Weekly Petroleum Status Report.
Data available in OGJ Online Research Center.

BAKER HUGHES RIG COUNT

	2-22-08	2-23-07
Alabama	3	3
Alaska	11	14
Arkansas	43	41
California	33	32
Land	32	28
Offshore	1	4
Colorado	112	95
Florida	0	0
Illinois	0	0
Indiana	1	1
Kansas	10	14
Kentucky	8	10
Louisiana	144	206
N. Land	48	57
S. Inland waters	19	26
S. Land	28	49
Offshore	49	74
Maryland	0	0
Michigan	1	2
Mississippi	9	16
Montana	10	22
Nebraska	0	0
New Mexico	65	85
New York	7	9
North Dakota	57	33
Ohio	12	13
Oklahoma	201	182
Pennsylvania	19	13
South Dakota	1	0
Texas	866	812
Offshore	5	11
Inland waters	3	2
Dist. 1	21	24
Dist. 2	34	30
Dist. 3	64	51
Dist. 4	90	94
Dist. 5	178	159
Dist. 6	128	126
Dist. 7B	30	41
Dist. 7C	43	48
Dist. 8	131	109
Dist. 8A	16	28
Dist. 9	44	34
Dist. 10	79	55
Utah	42	45
West Virginia	28	29
Wyoming	74	69
Others—NV-5; TN-6; VA-3	14	8
Total US	**1,771**	**1,754**
Total Canada	**647**	**603**
Grand total	**2,418**	**2,357**
Oil rigs	333	278
Gas rigs	1,430	1,472
Total offshore	55	89
Total cum. avg. YTD	**1,757**	**1,725**

Rotary rigs from spudding in to total depth.
Definitions, see OGJ Sept. 18, 2006, p. 42.

Source: Baker Hughes Inc.
Data available in OGJ Online Research Center.

SMITH RIG COUNT

Proposed depth, ft	Rig count	2-22-08 Percent footage*	Rig count	2-23-07 Percent footage*
0-2,500	73	5.4	50	—
2,501-5,000	109	52.2	100	57.9
5,001-7,500	213	21.1	224	18.3
7,501-10,000	446	4.4	426	3.9
10,001-12,500	436	4.3	418	3.8
12,501-15,000	307	0.3	279	1.0
15,001-17,500	94	—	109	1.8
17,501-20,000	74	—	78	—
20,001-over	38	—	39	—
Total	**1,790**	**8.1**	**1,723**	**7.9**
INLAND	32		38	
LAND	1,706		1,622	
OFFSHORE	52		63	

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

Source: Smith International Inc.
Data available in OGJ Online Research Center.

OGJ PRODUCTION REPORT

	[1]2-22-08	[2]2-23-07
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	14	19
Alaska	689	753
California	649	667
Colorado	47	37
Florida	5	6
Illinois	25	23
Kansas	94	95
Louisiana	1,319	1,316
Michigan	14	16
Mississippi	49	55
Montana	90	94
New Mexico	165	161
North Dakota	113	116
Oklahoma	170	173
Texas	1,329	1,335
Utah	44	53
Wyoming	142	144
All others	59	66
Total	**5,017**	**5,129**

[1]OGJ estimate. [2]Revised.

Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

US CRUDE PRICES

$/bbl*	2-22-08
Alaska-North Slope 27°	80.63
South Louisiana Sweet	101.50
California-Kern River 13°	86.15
Lost Hills 30°	94.25
Southwest Wyoming Sweet	90.31
East Texas Sweet	94.75
West Texas Sour 34°	87.75
West Texas Intermediate	95.25
Oklahoma Sweet	95.25
Texas Upper Gulf Coast	91.75
Michigan Sour	88.25
Kansas Common	94.50
North Dakota Sweet	87.00

*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 OGJ Online Research Center.

WORLD CRUDE PRICES

$/bbl[1]	2-15-08
United Kingdom-Brent 38°	95.41
Russia-Urals 32°	90.75
Saudi Light 34°	89.64
Dubai Fateh 32°	88.42
Algeria Saharan 44°	94.96
Nigeria-Bonny Light 37°	96.00
Indonesia-Minas 34°	94.17
Venezuela-Tia Juana Light 31°	89.00
Mexico-Isthmus 33°	88.89
OPEC basket	91.58
Total OPEC[2]	90.23
Total non-OPEC[2]	89.51
Total world[2]	89.91
US imports[3]	85.50

[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 OGJ Online Research Center.

US NATURAL GAS STORAGE[1]

	2-15-08	2-8-08	2-15-07	Change, %
	bcf			
Producing region	606	643	625	–3.0
Consuming region east	975	1,072	1,018	–4.2
Consuming region west	212	227	255	–16.9
Total US	**1,793**	**1,942**	**1,898**	**–5.5**
	Nov. 07	**Nov. 06**	**Change, %**	
Total US[2]	**3,456**	**3,407**	**1.4**	

[1]Working gas. [2]At end of period.
Source: Energy Information Administration.
Data available in OGJ Online Research Center.

PACE REFINING MARGINS

	Dec. 2007	Jan. 2008	Feb. 2008	Feb. 2007	2008 vs. 2007 Change	2008 vs. 2007 Change, %
	$/bbl					
US Gulf Coast						
West Texas Sour	9.53	9.20	12.36	11.78	0.58	4.9
Composite US Gulf Refinery	13.01	10.55	12.10	12.40	–0.31	–2.5
Arabian Light	15.39	10.03	8.84	13.70	–4.87	–35.5
Bonny Light	3.39	5.22	4.64	6.15	–1.51	–24.5
US PADD II						
Chicago (WTI)	6.87	5.32	5.30	11.33	–6.03	–53.2
US East Coast						
NY Harbor (Arab Med)	12.64	9.46	7.55	10.54	–3.00	–28.4
East Coast Comp-RFG	11.40	6.72	7.07	9.17	–2.10	–22.9
US West Coast						
Los Angeles (ANS)	12.31	6.36	12.79	23.96	–11.17	–46.6
NW Europe						
Rotterdam (Brent)	2.57	0.59	0.81	2.93	–2.12	–72.3
Mediterranean						
Italy (Urals)	7.44	6.30	8.84	7.99	0.85	10.6
Far East						
Singapore (Dubai)	3.65	1.89	5.08	2.84	2.24	78.9

Source: Jacobs Consultancy Inc.
Data available in OGJ Online Research Center.

US NATURAL GAS BALANCE DEMAND/SUPPLY SCOREBOARD

	Nov. 2007	Oct. 2007	Nov. 2006	Oct. 2007-2006 change	Total YTD 2007	Total YTD 2006	YTD 2007-2006 change
	bcf						
DEMAND							
Consumption	1,811	1,633	1,761	50	20,638	19,537	1,101
Addition to storage	148	334	159	–11	3,082	2,827	255
Exports	66	59	70	–4	696	652	44
Canada	38	30	45	–7	390	294	96
Mexico	25	25	20	5	262	301	–39
LNG	3	4	5	–2	44	57	–13
Total demand	**2,025**	**2,026**	**1,990**	**35**	**24,416**	**23,016**	**1,400**
SUPPLY							
Production (dry gas)	1,614	1,637	1,532	82	17,383	16,904	479
Supplemental gas	5	4	6	–1	57	60	–3
Storage withdrawal	255	76	206	49	2,688	2,050	638
Imports	346	343	338	8	4,163	3,803	360
Canada	319	309	290	29	3,413	3,262	151
Mexico	NA	2	1	–1	NA	9	–9
LNG	27	32	47	–20	750	532	218
Total supply	**2,220**	**2,060**	**2,082**	**138**	**24,291**	**22,817**	**1,474**

NATURAL GAS IN UNDERGROUND STORAGE

	Nov. 2007	Oct. 2007	Sept. 2007	Nov. 2006	Change
	bcf				
Base gas	4,238	4,236	4,232	4,216	22
Working gas	3,456	3,567	3,316	3,407	49
Total gas	**7,694**	**7,803**	**7,548**	**7,623**	**71**

Source: DOE Monthly Energy Review.
Data available in OGJ Online Research Center.

WORLDWIDE NGL PRODUCTION

	Nov. 2007	Oct. 2007	11 month average Production 2007	11 month average Production 2006	Change vs. previous year Volume	Change vs. previous year %
	1,000 b/d					
Brazil	88	85	84	86	–2	–2.2
Canada	668	678	692	673	18	2.7
Mexico	364	371	397	430	–33	–7.7
United States	1,868	1,837	1,772	1,739	33	1.9
Venezuela	200	200	200	200	—	—
Other Western Hemisphere	210	209	205	215	–10	–4.6
Western Hemisphere	**3,398**	**3,379**	**3,350**	**3,344**	**6**	**0.2**
Norway	316	296	283	284	–1	–0.2
United Kingdom	174	154	142	152	–10	–6.4
Other Western Europe	10	10	10	10	—	–2.1
Western Europe	**500**	**460**	**436**	**446**	**–10**	**–2.3**
Russia	424	428	426	416	10	2.5
Other FSU	160	160	160	160	—	—
Other Eastern Europe	15	14	15	17	–3	–15.2
Eastern Europe	**599**	**602**	**601**	**593**	**8**	**1.3**
Algeria	347	345	341	308	33	10.7
Egypt	70	70	70	73	–3	–4.1
Libya	80	80	80	86	–6	–7.0
Other Africa	188	187	187	191	–4	–2.2
Africa	**685**	**682**	**678**	**658**	**20**	**3.0**
Saudi Arabia	1,427	1,427	1,427	1,427	—	—
United Arab Emirates	250	250	250	250	—	—
Other Middle East	871	871	870	905	–34	–3.8
Middle East	**2,548**	**2,548**	**2,547**	**2,582**	**–34**	**–1.3**
Australia	68	73	74	81	–7	–8.6
China	180	180	180	180	—	—
India	—	—	3	41	–38	–91.6
Other Asia-Pacific	174	174	177	185	–9	–4.7
Asia-Pacific	**422**	**427**	**434**	**488**	**–53**	**–10.9**
TOTAL WORLD	**8,151**	**8,099**	**8,046**	**8,110**	**–64**	**–0.8**

Totals may not add due to rounding.
Source: Oil & Gas Journal.
Data available in OGJ Online Research Center.

OXYGENATES

	Nov. 2007	Oct. 2007	Change	YTD 2007	YTD 2006	Change
	1,000 bbl					
Fuel ethanol						
Production	14,356	14,018	338	139,255	104,581	34,674
Stocks	11,194	11,423	–223	11,194	9,212	1,982
MTBE						
Production	1,734	1,632	102	21,024	29,195	–8,171
Stocks	1,216	1,454	–238	1,216	1,460	–244

Source: DOE Petroleum Supply Monthly.
Data available in OGJ Online Research Center. **NOTE: No new data at presstime.**

US HEATING DEGREE-DAYS

	Jan. 2008	Jan. 2007	Normal	2008 % change from normal	Total degree-days July 1 through Jan. 31 2008	Total degree-days July 1 through Jan. 31 2007	Total degree-days July 1 through Jan. 31 Normal	% change from normal
New England	1,130	1,106	1,246	–9.3	3,503	3,227	3,708	–5.5
Middle Atlantic	1,023	979	1,158	–11.7	2,963	2,778	3,349	–11.5
East North Central	1,216	1,112	1,302	–6.6	3,477	3,378	3,774	–7.9
West North Central	1,367	1,277	1,390	–1.7	3,900	3,740	4,085	–4.5
South Atlantic	609	509	643	–5.3	1,503	1,477	1,726	–12.9
East South Central	825	706	820	0.6	1,991	2,047	2,230	–10.7
West South Central	582	630	593	–1.9	1,365	1,451	1,498	–8.9
Mountain	1,011	50	951	6.3	2,940	3,084	3,098	–5.1
Pacific	627	626	564	11.2	1,849	1,749	1,817	1.8
US average*	**883**	**835**	**917**	**–3.7**	**2,455**	**2,390**	**2,656**	**–7.6**

*Excludes Alaska and Hawaii.
Source: DOE Monthly Energy Review.
Data available in OGJ Online Research Center.

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As our industry confronts new challenges, it has never been more important to submerse yourself in them. This year's theme is "Subsea is here, the game is changing." As our game changes, the sharing of knowledge and collective experiences becomes more and more crucial to improving the quality, safety, and economics of the subsea tieback industry.

The conference board will once again solicit a number of key presentations by industry leaders. As in the past, only by participating in this conference will you be able to receive its benefits, as proceedings will not be published and no Press is ever allowed in the conference area. This is truly a closed forum with open discussion, where the information shared inside the conference room stays inside the conference room. We hope you will join us.

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CBO: CO_2 tax the best move on climate change

The Congressional Budget Office is right to favor a tax on carbon dioxide over other possible US responses to climate change. But it omits an important reason.

In a February report, CBO compares a CO_2 tax with an inflexible cap and two cap-and-trade systems.

It uses three criteria: efficiency, implementation considerations, and consistency with mitigation efforts elsewhere in the world.

CBO considers a CO_2 tax the best option. Net benefits of a tax could be five times those of an inflexible cap, the worst option, CBO says.

Second-best, according to the agency, would be a cap-and-trade system with a price ceiling plus either a price floor or banking provisions. Cap-and-trade schemes set limits on total CO_2 emissions and assign emission allowances to regulated companies. The companies can sell allowances they don't use and buy extra allowances they need.

A price ceiling would limit unexpected cost surges and help coordinate a US system with those in use elsewhere. Under banking provisions, companies could hold allowances for use in the future.

Third-best in CBO's ranking is a cap varying with the price of allowances along with banking plus either of two other features: a limit on how much the cap could tighten if allowances exceeded a certain price or the ability, adjustable by government, to borrow future allowances for earlier use.

Obviously, the cap-and-trade schemes require government intervention. CBO doesn't say so, but so large an official hand in potentially so large a market would create opportunities for corruption. Small details about system design, implementation, and operation could be worth big money to people willing to pay for advantage.

But that's not the missing reason to favor a straight-up tax as a tool for discouraging CO_2 emissions.

However they came about, meaningful cuts in CO_2 emissions would be painfully expensive. People, not businesses, would bear the burden. Inflexible caps and cap-and-trade schemes are just camouflage.

Governments determined to require CO_2 cuts despite questions that the effort can affect global temperature must warn people about the cost. Proposing a tax is the clearest way to do it.

It is, in fact, the only honest option.

(Online Feb. 22, 2008; author's e-mail: bobt@ogjonline.com)

The Editor's Perspective

by Bob Tippee, Editor

Market Journal

by Sam Fletcher, Senior Writer

Crude closes above $100/bbl

For the first time ever, a front-month contract for benchmark US light, sweet crudes closed above $100/bbl Feb. 19—at $100.01/bbl, up $4.51 for the day—after setting a new intraday record of $100.10/bbl on the New York Mercantile Exchange.

The expiring March contract hit a subsequent high of $101.32/bbl in intraday trading Feb. 20 before closing at a record $100.74/bbl in New York, having climbed more than $10/bbl over the seven previous sessions as Venezuela announced it would halt direct oil sales to ExxonMobil Corp. (OGJ Online, Feb. 13, 2008). The new front-month April contract closed unchanged at $99.70/bbl after fluctuating between $97.99/bbl and $100.86/bbl in the same session, but its "ability to rebound from the day's low" demonstrated "its remaining intrinsic strength," said Olivier Jakob at Petromatrix, Zug, Switzerland. With this strong technical rally, NYMEX crude futures prices moved to the top of the wider $86-100/bbl range that has been in place since October. Jakob said, "It is one thing to trade technically within a range, but it takes conviction to break it."

Crude futures first touched $100/bbl in intraday trading Jan. 2 during the first NYMEX session of 2008, then climbed a few cents above that historic high in the next session before falling back in subsequent weeks. But it fluctuated generally at $85-95/bbl for several weeks prior to the latest price run-up.

Prices climbed as several recent incidents reminded traders that petroleum supplies are nearly always at risk. Four workers were injured Feb. 18 in an explosion and fire at Dallas-based Alon USA Energy Inc.'s 70,000 b/d sour crude refinery in Big Spring, Tex. (OGJ Online, Feb. 19, 2008). The entire refinery was damaged in the mishap, officials said, and may resume only partial operations in 2 months.

Henry Okah, leader of the Movement for the Emancipation of the Niger Delta, was extradited from Angola to face charges in Nigeria for murder, arms dealing, oil smuggling, and other crimes. That could ignite a new round of violence by militants that would derail peace talks between the Nigerian government and the rebels.

Energy prices pulled back Feb. 21 with crude down to $98.23/bbl, ending a 6-session rally, when the Energy Information Administration reported a larger-than-expected increase in US crude inventories. But on Feb. 22, the April contract pushed as high as $99.37/bb before closing at $98.81/bbl. None of these incidents materially affected market fundamentals of supply and demand. But as often happens, they provided the excuse for traders to move in the direction toward which they were already inclined.

US inventories

EIA reported crude inventories rose 4.2 million bbl to 305.3 million bbl in the week ended Feb. 15, up from a Wall Street consensus of a 2.7 million bbl increase. Gasoline inventories gained 1.1 million bbl to 230.3 million bbl in the same week vs. Wall Street expectations of a 500,000 bbl increase. Distillate fuel inventories fell 4.5 million bbl to 122.5 million bbl, more than the expected decline of 1.7 million bbl. Imports of crude into the US increased by 365,000 b/d to 10.1 million b/d. The input of crude into US refineries fell, however, down 97,000 b/d to 14.5 million b/d with refineries operating at 83.5% of capacity that week. Gasoline production declined to 8.8 million b/d, with distillate fuel production down to 4 million b/d.

Michael C. Schmitz, Banc of America Securities LLC, New York, said, "The larger-than-expected build [in crude] was primarily due to a decline in refinery utilization from 85.1% the prior week to 83.5% (the lowest since March 2006) due to seasonal maintenance, combined with an increase in imports to 10.1 million b/d from 9.7 million b/d the prior week. Thus, current crude inventories of 305 million bbl, which equate to about 21 days of demand coverage, were 6.8% below last year and 0.6% above the 10-year average. Gasoline production averaged 70,000 b/d lower than the prior week with low utilization being partially offset by above-normal product yields....Total [gasoline] imports remained essentially flat."

Jacques H. Rousseau, an analyst at Soleil-Back Bay Research., noted that refined product inventories of gasoline, distillate, and jet fuel dropped 4.7 million bbl (1.2%) vs. the prior week, marking "the first decline in 9 weeks." Rousseau said, "We expect this positive trend to continue due to seasonal rising demand (which increased 6% week-over-week) and lower supply. We view falling inventories as a leading indicator for improvements in refining margins and share prices." He said refined product inventories should decline by 10% by the end of the first quarter.

(Online Feb. 25, 2008; author's e-mail: samf@ogjonline.com)