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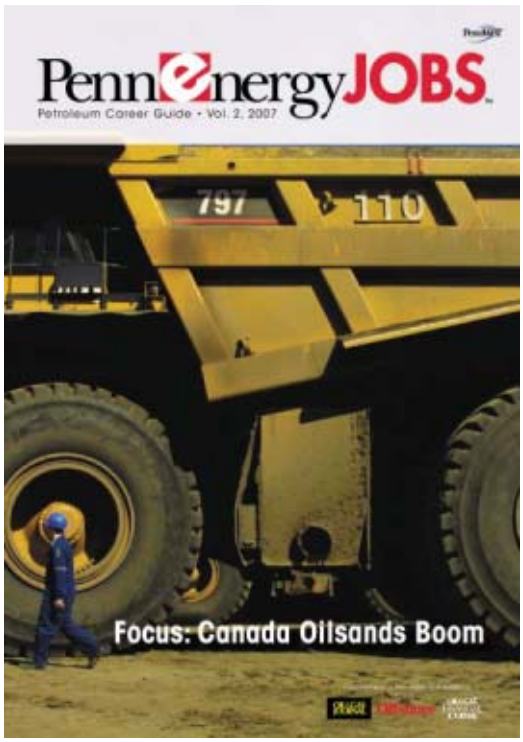

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Gulf of Mexico Focus

Massive rock ploughs formed structures in western Canada
Custom-built rig uses reverse-circulation pipe to drill basalt
Heat-stable salts reduce H_2S leaking from amine absorbers
Improved database management yields pipeline integrity benefits

OIL&GAS JOURNAL®

June 11, 2007
Volume 105.22

GULF OF MEXICO FOCUS

REGULAR FEATURES

COVER

Two tugs start the gas processing platform of the Independence Hub on its route to installation in 8,000 ft of water on Mississippi Canyon Block 920, the deepest water depth of any offshore platform in the Gulf of Mexico. With Anadarko Petroleum Corp. as operator, the hub also has the largest gas production capacity in the gulf at 1 bcfd, representing a 10% increase in current gas deliveries from those waters. Above, workers assemble the Neptune SeaStar monocolumn tension-leg platform hull in the Signal International LLC dry dock yard, Port Arthur, Tex. BHP Billiton Petroleum (Americas) Inc., operator, launched the hull for the Neptune TLP in late May for installation in 4,250 ft, above the Sigsbee escarpment. The US gulf is one of three regions—including the North Sea and South China Sea—that together are expected to receive half of total offshore spending through 2011. Oil production from the gulf is expected to increase to "a possible high" of 2.1 million b/d over the next 10 years. Conventional drilling for gas on the Outer Continental Shelf faces stiff competition from other gas-producing areas. But deep water and deep drilling are still attracting a special group of producers with the skills and technologies to tackle those challenges. Read OGJ's exclusive report beginning on p. 20. Cover photo from Anadarko. Above photo from BHP.

General Interest

Exploration & Development

Drilling & Production

Processing

Transportation

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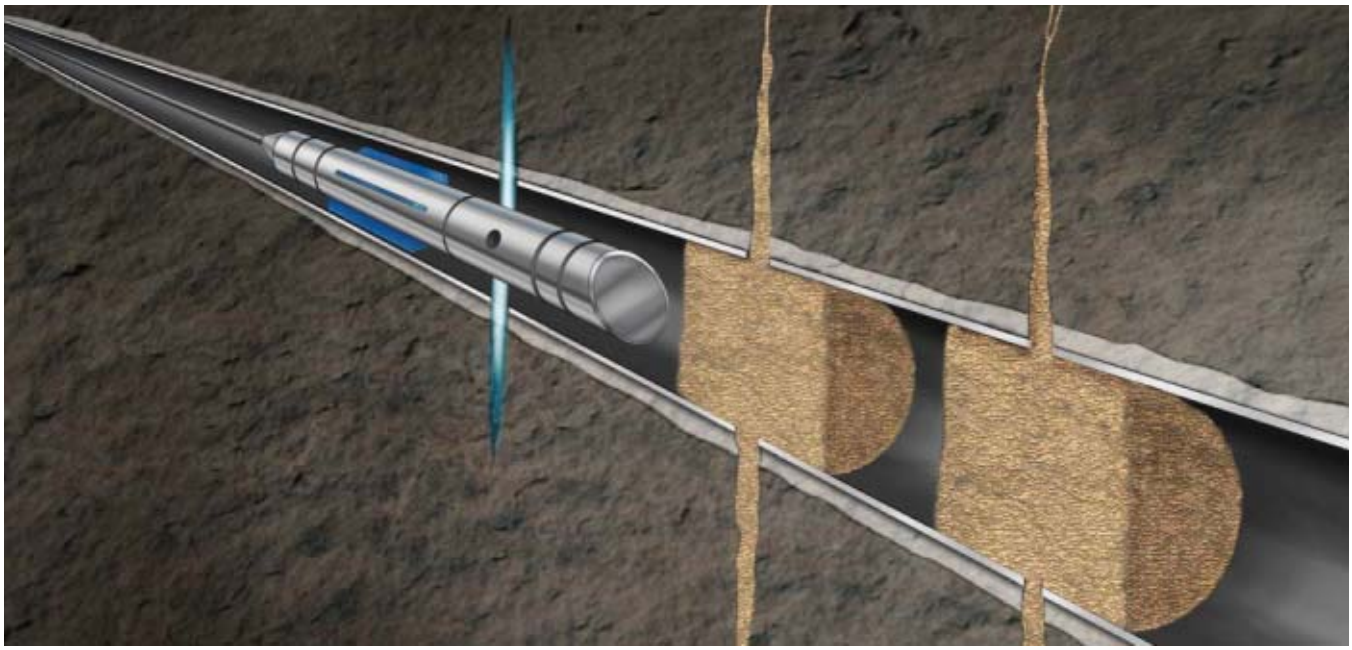

What is reliability worth?

Overcoming flow-convergence issues with maximum near-wellbore conductivity.

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- Consistently create fractures in cased and cemented horizontal wellbores
- Optimize frac design
- Overcome flow-convergence issues, especially in near-wellbore region

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Production Optimization

OGJ Newsletter

June 11, 2007

International news for oil and gas professionals
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General Interest — Quick Takes

Norway plans $17.6 billion budget for NCS

Norway expects operators will spend $17.6 billion on the Norwegian Continental Shelf in 2007, according to the revised 2007 national budget published by Norway's petroleum ministry. The sum is $2.2 billion higher than the last estimate in its national budget for 2007.

The ministry said investment is expected to rise over coming years and attributed the difference to escalating well costs. Production and exploration wells as well as average well costs have all increased since the 2007 national budget was published, it added.

Average Norwegian oil prices are expected to be $61/bbl for 2007 and $58/bbl for 2008 under its revised national budget. The Organization of Petroleum Exporting Countries has reduced its production twice in the last 6 months, and the cartel appears to be aiming for a price of $55-60/bbl, the ministry said.

According to the revised budget, Norwegian oil production, including natural gas liquids, is expected to be 2.6 million b/d in 2007, which would be "slightly lower than the production in 2006," the ministry said. However, production should rise in 2008, although the ministry did not indicate by how much, and this would gradually trail off in the following years.

The ministry also has reduced slightly its figures for gas sales. Norway should sell 93 billion cu m in 2007 and 109 billion cu m in 2008. Gas sales should increase once production from delayed projects comes on stream after 2008.

Odd Roger Enoksen, Norway's minister of petroleum and energy, said Norway is expected to sell more than 90 billion cu m of gas to Europe in 2007.

The ministry estimates that the state's net cash flow from the petroleum sector will be $49.9 billion in 2007, down $10 billion compared with the original estimate in the 2007 national budget. The reduction is the result of reduced oil price estimates, lower production, increased investments, and a rise in operating costs.

The revised budget, presented to Norway's parliament The Storting on May 15, outlines the government's plan to implement economic policy and projections for the revised Norwegian economy.

Group to implement LNG training standards

The US Maritime Administration (USMA), seafaring unions, and seafaring academies agreed June 5 to implement training standards for LNG tanker crews.

"The mariners who meet these standards will be the best in the world. They're the ones companies will want to hire," USMA administrator Sean T. Connaughton said.

The US once led LNG maritime training worldwide, but that leadership has lapsed, Connaughton said. US standardized training from the Merchant Marine Academy and other academies will help regain that leadership, he said.

The memorandum of understanding will be submitted to the US Coast Guard's advisory committee on merchant marine issues. Maritime academies and labor-based training facilities plan to adopt the standards.

USMA will encourage more US mariners to join LNG tanker crews.

The new US standards also will be submitted to the International Maritime Organization in London for proposed implementation worldwide, Connaughton said.

"We've come up with a curriculum above and beyond what's being offered internationally," Connaughton said.

Some maritime academies, including the Texas A&M Maritime Academy in Galveston, Tex., already were working to improving LNG mariner training programs when the standards group was assembled.

Chester Urban, a deck department adjunct instructor in LNG programs at the RTM STAR (Simulation, Training, Assessment & Research) Center in Dania Beach, Fla., said certified US mariners will be able to work on modifications to qualify themselves for LNG tanker duty. "There will be different levels. It will be up to the individual," Urban explained.

Connaughton said two carriers active in LNG maritime transportation, Teekay Shipping Corp. and Excelerate Energy LLC, agreed to ultimately staff at least 25% of their LNG crews with US mariners. Others will be announced shortly, he indicated.

California Geysers geothermal expansion set

Calpine Corp., San Jose, Calif., plans a 2-year multirig drilling program to increase electricity production by as much as 80 Mw at its Geysers geothermal operation in northern California.

The $200 million program is designed to expand dry steam production, identify new sources of geothermal power, and rebuild four older geothermal turbines to improve energy efficiency. Some of the new wells will be as deep as 11,000 ft.

The company said it will consider further development at Geysers Geothermal field if it is able to enter into long-term power sales contracts.

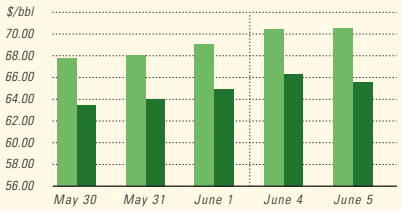
The field has 350 steam wells and 58 injection wells on 40 sq miles with 80 miles of steam lines. The operation, first drilled in 1954, is in the Mayacamas Mountains near Middletown, 70 miles north of San Francisco.

Calpine, which also operates gas-fired electric generating facilities, supports a state goal of obtaining 20% of its power from renewable sources by 2010.

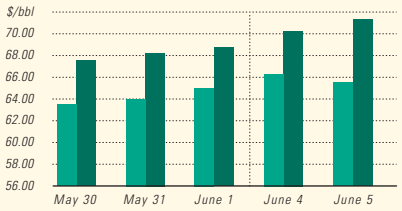
Geysers, the world's largest geothermal operation, generates 725 Mw of electricity and represents 25% of California's renewable energy production and 40% of US geothermal electrical gen-

Industry Scoreboard

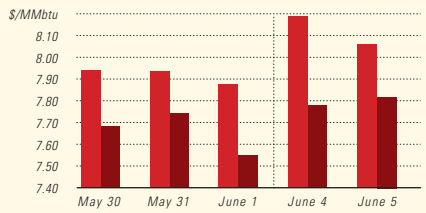
IPE BRENT / NYMEX LIGHT SWEET CRUDE



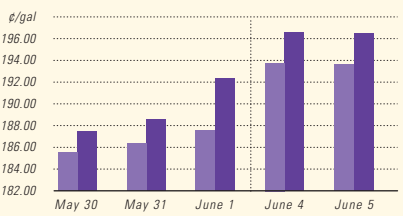
WTI CUSHING / BRENT SPOT



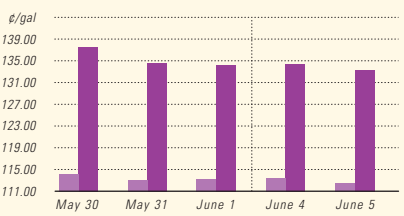
NYMEX NATURAL GAS / SPOT GAS - HENRY HUB



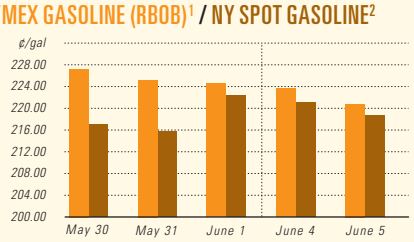
IPE GAS OIL / NYMEX HEATING OIL



PROPANE - MT. BELVIEU / BUTANE - MT. BELVIEU



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



[1]Reformulated gasoline blendstock for oxygen blending
[2]Nonoxygenated regular unleaded.

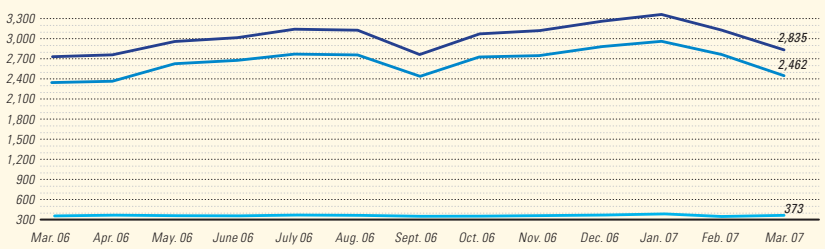
US INDUSTRY SCOREBOARD — 6/11

Latest week 6/1	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	9,279	9,317	–0.4	9,149	9,097	0.6
Distillate	4,082	4,060	0.5	4,336	4,183	3.7
Jet fuel	1,559	1,643	–5.1	1,599	1,604	–0.3
Residual	817	600	36.2	771	724	6.5
Other products	4,891	4,857	0.7	4,958	4,832	2.6
TOTAL DEMAND	20,629	20,478	0.7	20,814	20,440	1.8
Supply, 1,000 b/d						
Crude production	5,189	5,104	1.7	5,242	5,083	3.1
NGL production[2]	2,248	2,473	–9.1	2,383	2,140	11.4
Crude imports	9,949	10,241	–2.8	9,809	10,021	–2.1
Product imports	3,619	3,957	–8.5	3,260	3,555	–8.3
Other supply[3]	1,049	764	37.4	975	1,092	–10.7
TOTAL SUPPLY	22,054	22,539	2.2	21,670	21,891	–1.0
Refining, 1,000 b/d						
Crude runs to stills	15,016	15,531	–3.3	14,729	15,047	–2.1
Input to crude stills	15,482	15,866	–2.4	15,172	15,388	–1.4
% utilization	89.3	91.2	—	87.5	88.6	—

Latest week 6/1	Latest week	Previous week[1]	Change	Same week year ago[1]	Change	Change, %
Stocks, 1,000 bbl						
Crude oil	346,436	352,091	–5,655	344,696	1,740	0.5
Motor gasoline	208,541	201,374	7,167	210,966	–2,425	–1.1
Distillate	124,867	121,400	3,467	121,690	3,177	2.6
Jet fuel	41,488	40,177	1,311	40,103	1,385	3.5
Residual	35,526	36,642	–1,116	41,379	–5,853	–14.1
Stock cover (days)[4] **5/25**			**Change, %**		**Change, %**	
Crude	22.1	22.4	–1.3	22.5	–1.8	
Motor gasoline	21.0	21.0	—	22.4	–6.2	
Distillate	28.8	28.8	—	29.0	–0.7	
Propane	37.9	35.7	6.2	37.9	—	
Futures prices[5] **6/1**			**Change**		**Change**	**Change, %**
Light sweet crude, $/bbl	63.93	65.03	–1.10	71.50	–7.57	–10.6
Natural gas, $/MMbtu	7.84	7.76	0.08	6.40	1.44	22.5

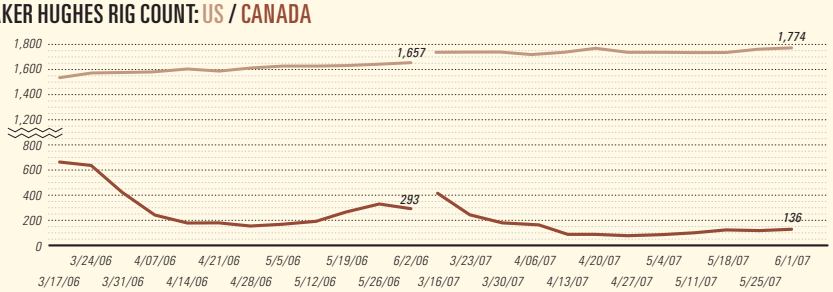
[1]Based on revised figures. [2]Includes adjustments for fuel ethanol and motor gasoline blending components. [3]Includes other hydrocarbons and alcohol, refinery processing gain, and unaccounted for crude oil. [4]Stocks divided by average daily product supplied for the prior 4 weeks. [5]Weekly average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

eration. Calpine owns 19 of the 21 geothermal units at the field. The generators connect with five major transmission lines that can deliver power statewide.

The project also recycles wastewater from nearby towns through the geothermal reservoirs for conversion into steam for electricity production. ✦

Exploration & Development — *Quick Takes*

Barnett play moves far south of Fort Worth

Operators are finding apparently commercial volumes of gas in the Mississippian Barnett shale as far as 100 miles south of Fort Worth.

Considerable drilling is taking place near Waco in Hill County 55 miles south of Fort Worth, and leasing and drilling are under way in Hamilton, Comanche, and even Lampasas counties 100 miles south of Fort Worth, according to a presentation by Westside Energy Corp., Dallas.

Operators are completing Barnett gas wells in Hill County, which had no commercial production for years. The county now has at least several dozen wells permitted, most of which are to be horizontal penetrations.

Operators working in Hill County include EOG Resources Inc., Devon Energy Corp., DTE Gas Resources, JW Operating Co., EnCana Corp., Quicksilver Resources Inc., a joint venture of Westside and Forest Oil Corp., and several others.

Westside and Forest this month are drilling the horizontal section of a third Hill County well, Primula 2H. The second well, Ellison Estate 1H, tested at an initial 1.9 MMcfd of gas on a $^{40}/_{64}$-in. choke while returning completion fluid.

The companies' first well, Primula 1H, gauged 2.1 MMcfd from a 1,600-ft lateral in February.

Since mid-2006, various operators have reported initial potentials of 1.5-3.2 MMcfd from Hill County Barnett horizontal completions. Westside's economic assumptions are completed well costs of $3 million and estimated ultimate recoveries of 2 bcf/well on 60-acre spacing at $5/Mcf.

Meanwhile, Westside has accumulated 52,000 net acres west of Waco in Comanche, Mills, Hamilton, Coryell, and Lampasas counties. Marathon Oil Corp. has completed one vertical and six horizontal wells in Hamilton County and has built a pipeline, Westside said. The Barnett shale is 130-220 ft thick at 4,500 ft in these areas.

Norway okays Statoil's Gjøa field development

Norway has approved Statoil ASA's development and operation plan for Gjøa oil and gas field in the North Sea, bringing it a step closer to fruition. Statoil and partners must secure a final approval from the Norwegian parliament this summer before they can develop Gjøa using subsea templates tied back to a semisubmersible rig.

Kjetel Digre, leader of the Gjøa project at Statoil, said the planned development "allows flexibility with regard to the possibility of new recoverable finds in the area.... The development of the Hydro-operated Vega field can now be implemented in a profitable way." The small Hydro-operated condensate and gas fields Vega and Vega South are to be tied back to the Gjøa platform, which otherwise, developed by themselves would not be economic.

The chosen development concept ties in the three Norsk Hydro AS-operated oil and gas deposits—Camilla, Belinda, and Fram B—to Gjøa. Production is expected to start in 2010 and the investment will cost 27 billion kroner in 2006 money.

The Gjøa field, proven in 1989, lies 70 km north of Troll oil field on Blocks 35/9 and 36/7. The reserves are estimated at 60 million bbl of oil and condensate and 35 billion cu m of gas. The gas will be sent through the UK pipeline Flags to St. Fergus, Scotland. The oil will be piped to the Troll II line and further to the Statoil-operated 200,000 b/cd Mongstad refinery north of Bergen. Digre said: "Gjøa oil is of good quality and will be important for future supply of raw materials to the Mongstad refinery."

He added that the company has demonstrated that it can be profitable to use onshore power to meet Gjøa's power needs on the platform. "With power from land, we will be able to remove up to five gas turbines which otherwise would generate platform electricity. Hence we avoid large carbon and nitrogen oxide emissions."

The electricity generation license application is now being considered by the Norwegian Water Resources and Energy Directorate (NVE). "Plans call for coordinated electricity generation from the Mongstad energy project (EVM). A combined heat and power (CHP) station at Mongstad, north of Bergen, will come into operation in 2010," Statoil said. Statoil is development operator with Gaz de France as production operator.

Interests in the Gjøa license are Gaz de France 30%, Petoro SA 30%, Statoil 20%, Royal Dutch Shell PLC 12%, and RWE Dea AG 8%.

Talisman lets engineering contract for Yme field

Talisman Energy Inc., operator of Yme field, let a €110 million, turnkey contract to Technip on behalf of its consortium members to undertake engineering work for the redevelopment of the Norwegian North Sea field.

Technip will design, procure, fabricate, and install 36 km of production, water injection, and service-rigid flow lines. It also will install umbilicals, spools, subsea protection structures, and a manifold. The contract also covers tie-in, trenching, rock dumping, and precommissioning of the field.

Technip's Apache pipelay vessel will install the flow lines along with other vessels in the company. Offshore installation is scheduled for 2008 and 2009.

Norway approved the plan for development of Yme field earlier this year (OGJ Online, May 14, 2007). The partners will drill 12 production and injection wells, install a production platform to process oil and gas, and establish water injection facilities. First production is planned for 2009 with expected maximum gross production of 40,000 b/d of oil.

Talisman holds a 70% stake in the PL 316 license that includes the Yme field. Revus Energy ASA has 20% and Pertra ASA has 10%.

Giddings gas flows in Montgomery County

Southern Bay Operating LLC, Houston, said it holds enough acreage to support spudding a well every 60-90 days for 2-3 years for Austin chalk gas in the Grimes-Montgomery extension area of Giddings field on the Texas Gulf Coast. Leasing continues.

The 1H WPT Gas Unit in Montgomery County east of Richards, Tex., second development well drilled and completed since a property acquisition in February 2007, made an initial 14.5 MMcfd of dry gas. Higher rates are probable with pipeline adjustments in progress. A third well, 1H Ashorn Unit, is drilling.

The chalk is at 14,000 ft TVD, and the wells have 5,500-6,000-ft laterals. Unit sizes range from 400 to 800 acres and average 600 acres. Southern Bay is operator and partnership manager with 10% interest subject to potential increased reversionary interests.

As the result of an Apr. 17 merger, Southern Bay Oil & Gas LP, Houston, and Chandler Energy LLC, Denver, became subsidiaries of GeoResources Inc., which moved headquarters to Houston from Williston, ND, now a regional office. G3 Operating LLC, Denver, operates GeoResources' northern region.

GeoResources sold its rotary rig to Redhawk Drilling LLC, Mohall, ND, as of May 24. ✦

Drilling & Production — *Quick Takes*

Cross-border Enoch oil field comes on stream

First oil production has begun from Enoch field in the North Sea, reported field operator Talisman North Sea Ltd. The cross-border field is 160 miles northeast of Aberdeen and straddles the UK and Norwegian sectors in UKCS Block 16/13a and NCS Block 15/5 (unitized at 80% and 20%, respectively).

Production, expected to produce 15,000 boe/d at peak, is from a single horizontal development well, which Talisman drilled in 2006. The oil will be processed at the Brae Alpha facility 10 miles northwest of Enoch and exported via the Forties pipeline network.

Enoch field has passed through a number of operators since 1985. Talisman holds 24% interest; Dyas UK Ltd. holds 14%, Bow Valley Petroleum (UK) Ltd. 12%, Roc Oil (GB) Ltd. 12%, Dana Petroleum (E&P) Ltd. 8.8%, and Statoil ASA 11.78%.

McDermott to build Manifa oil platforms

Saudi Aramco has let a lump-sum turnkey contract to J. Ray McDermott Inc. to design, procure, fabricate, transport, install, and connect offshore platforms for Manifa oil field in the Persian Gulf. The field is expected to produce 900,000 b/d of oil and 90 MMscfd of gas in mid-2011. The value of the contract was not disclosed.

Aramco Vice-Pres. of Project Management Ali A. Al-Ajmi described the deal as a "critical phase of the massive Manifa increment."

Aramco's Manifa project includes building 13 offshore platforms and modifying 26 existing offshore observation well platforms. "The new facilities support the structures required for the six oil production deck modules that are designed to accommodate equipment required for the electric submersible pumps and seven new water injection platforms," the company said.

Manifa also will have four major downstream pipelines and terminal facilities at Ju'aymah and Ras Tanura. Gas processing infrastructure will be built at the Khursaniyah gas plant to handle gas and the 65,000 b/d of condensate that will be produced from onshore and offshore areas of Manifa.

Incorporating its other major oil and gas projects that are underway or are to be built—Hawiyah NGL, Khursaniyah, Khurais, Shaybah, and Manifa—Saudi Arabia expects to add nearly 4 million b/d of capacity in 2011, adding almost 5% to the world's oil supply. ✦

Processing — *Quick Takes*

Rosneft to increase refining capacities, M&As

Russia's OAO Rosneft plans to increase its refining capacities eightfold during 2006-15 to bolster its downstream development, said Chairman and Chief Executive Sergei Bogdanchikov at the Energy Exchange's CIS Oil & Gas Summit in Paris May 30-June 1.

Bogdanchikov said Rosneft would increase its refining capacity in both Russia and abroad through either acquisitions or partnerships, with preference given to acquisitions abroad, particularly in the Far East.

Rosneft, which is 75% state-owned, is emerging as "a super-NOC" from its current national oil company status, Bogdanchikov said.

It already has access to "policy-makers," mergers and acquisitions, and resources. It also cooperates with the government and is insulated from political risk, he said.

As a supermajor it can now boast "capital discipline, cost efficiency, shareholder value creation, enhanced corporate governance, and transparency," he said. He detailed the group's shareholder base as the Russian State, institutional investors from over 40 countries, about 150,000 ordinary Russian citizens, NOCs, and other supermajors.

Pointing out that Rosneft was sharing experience and technology with leading service companies and is engaged in cooperation with leading oil and gas companies through which it is "implementing the best technology," as well as sharing experience, risks, and investments, Bogdanchikov said the group could finance its projects, including Sakhalin 5, alone but would invite partners for offshore projects "to deal with their complexity."

He also said summit sponsor Total SA might "soon" share involvement in Rosneft projects.

Fos-sur-Mer vacuum distillation tower on stream

Esso Raffinage SAF has brought on stream the new vacuum distillation tower at its 110,000 b/d Fos-sur-Mer refinery. The equipment will increase distillate production to raise the refinery's diesel

oil production (OGJ Online, Mar. 26, 2007).

The investment, the cost of which was not disclosed, will also improve the energy efficiency of the refinery and cut down its carbon dioxide emissions.

In 2006, the Fos-sur-Mer refinery treated 5.8 million tonnes of crude.

Sonatrach lets contract for Hassi Messaoud plant

Algeria's state-run Sonatrach has awarded Saipem SPA a 3-year, $700 million contract for the engineering, procurement, and construction of an oil treatment and stabilization plant in Hassi Messaoud, 800 km southeast of Algiers.

Sonatrach said the plant will comprise three trains, each with 100,000 b/d of oil capacity, one maintenance unit, four stocking units of 50,000 cu m each, and a 45-km pipeline transporting oil, water, and gas. Works are expected to last 37 months.

The project, aiming to enhance crude quality and improve safety and production rates, is expected to contribute significantly to the production optimization program of Sonatrach's Hassi Messaoud field, Sonatrach said, given the extent of the field's reserves, their quality, and the complexity of the reservoirs. ✦

Transportation — *Quick Takes*

BG Group to supply gas to Chile LNG terminal

BG Group has signed an agreement to supply Chile's first LNG regasification terminal, a 2.5 million tonne/year facility to be built in Quintero Bay, about 110 km northwest of Santiago. The terminal is slated to begin operating in second quarter 2009.

The terminal could meet as much as 40% of Chile's gas demand, organizers said. GNL Quintero SA (GNLQ) will own and operate the terminal. BG is a 40% shareholder in GNLQ. Other partners, each with a 20% stake, are Chilean state company ENAP, power company Endesa Chile, and gas distributor Metrogas.

BG executed the 21-year LNG sale and purchase agreement to supply Chile with 1.7 million tonnes/year of LNG through the terminal, to be supplied from the company's global LNG portfolio.

ENAP said the LNG project will cost $400 million and, once commissioned, will supply gas to the country at competitive prices. It said the Quintero LNG complex will comprise a quay about 1,300 m long, unloading arms, and two storage tanks of around 160,000 cu m capacity each, in addition to the regasification station.

GNLQ also announced it let engineering, procurement, and construction contracts valued at $775 million to CB&I of The Woodlands, Tex.

Short-term deals to get 10% of Fos Cavaou LNG

The Fos Cavaou LNG terminal in southeastern France will have to free 10% of its 8.25 billion cu m/year capacity for short-term contracts when it comes into operation beginning in 2008. The Energy Regulatory Commission on May 16 issued the notice to Société du Terminal Méthanier de Fos Cavaou, the company that will operate the terminal on behalf of its owners Gaz de France 69.7% and Total 30.3%.

The move is in line with the commission's policy to bolster competition in southern France, which lacks gas supply sources. In addition, access to GDF's and Total's gas lines remains "uncertain" over the 2008-11 period, the commission said. It also indicated that the current gas release program will gradually end over 2008.

Decisions for the development of interconnections with Spain are still pending, so it is necessary to allocate the full available capacities of the Fos Cavaou terminal to boost competition for final consumers in southern France.

The 10% spare capacity will be for 3-year, short-term contracts involving 10 Tw-hr/year, equal to 825 million cu m. The tariff, suggests the commission, should be the same as that of existing terminals—about €1.3/Mw-hr over 2008-11.

The commission also indicates that annual operating costs for Fos-Cavaou will average €38 million over the period, while costs engaged until the terminals comes on stream are estimated by the operating company at around €11 million. Full cost of the terminal up to the time it comes on stream should be about €588 million.

Abu Dhabi lets pipeline contract to CNPC units

China National Petroleum Corp. said Abu Dhabi's International Petroleum Investment Co. has awarded a contract to CNPC's two pipeline engineering and construction units, China Petroleum Pipeline Bureau and China Petroleum Engineering & Construction Corp., to jointly build a 360-km, 48-in. oil pipeline in the UAE. The pipeline will extend from Abu Dhabi's Habshan oil field to an export terminal at Fujairah. Starting and completion dates were not given.

The line will carry 1.5 million b/d of crude oil, about 55% of the Emirates' production. A third of the crude will be transported to a planned $5 billion refinery in Fujairah, while the remainder would be piped to the export terminal, bypassing the Strait of Hormuz.

Under an original 2006 agreement, IPIC and ConocoPhillips were expected to form a 51-49 joint venture to own and operate the 500,000 b/d Fujairah refinery complex (OGJ, July 24, 2006, Newsletter). In April, however, ConocoPhillips said rising costs had cast doubts on its participation in the refinery, so IPIC last month said it would revise its plan for the refinery. ✦

Corrections

In the special report on managing carbon dioxide, API's SANGEA Energy and Emissions Estimating System was developed originally by Chevron Corp. with the assistance of staff currently with Battelle (OGJ, May 14, 2007, p. 27).

In the special report on OPEC's new direction, a map of 2005 US gas imports and exports contained a misspelling of the Sabine Pass LNG receiving terminal (OGJ, May 28, 2007, p. 26).

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2007

JUNE

Society of Petroleum Evaluation Engineers Annual Meeting, Vail, Colo., (713) 651-1639, e-mail: bkspee@aol.com, website: www.spee.org. 9-12.

PIRA Scenario Planning Conference, London, 212-686-6808, 212-686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 11.

Asian Petrochemicals & Gas Technology Conference & Exhibition, Kuala Lumpur, +44 (0) 20 7357 8394, e-mail: Conference@EuroPetro.com, website: www.europetro.com. 11-12.

Central European Gas Conference, Berlin, +44 (0)20 8275 5198, +44 (0)20 8275 5401 (fax), e-mail: CEGC@lynne-evens.com, website: www.thecegc.com. 11-13.

ERTC Refining Management and Strategy Conference, Vienna, 44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 11-13.

ILTA Annual International Operating Conference & Trade Show, Houston, (202) 842-9200, (202) 326-8660 (fax), e-mail: info@ilta.org, website: www.ilta.org. 11-13.

IPAA Midyear Meeting, Henderson, Nev., (202) 857-4722, (202) 857-4799 (fax), website: www.ipaa.org/meetings. 11-13.

EAGE/SPE Europec Conference and Exhibition, London, +31 30 6354055, +31 30 6343524 (fax), e-mail: eage@eage.org, website: www.eage.org. 11-14.

PIRA London Energy Conference, London, 212-686-6808, 212-686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 12.

Health and Safety Excellence Conference, Barcelona, +420 257 218 505, +420 257 218 508 (fax), e-mail: healthandsafety@jacobfleming.com, website: www.jacobfleming.com. 12-13.

GO-EXPO Gas and Oil Exposition, Calgary, Alta., (403) 209-3555, (403) 245-8649 (fax), website: www.petroleumshow.com. 12-14.

Asian Downstream Technology & Catalyst Conference & Exhibition, Kuala Lumpur, +44 (0) 20 7357 8394, e-mail: Conference@EuroPetro.com, website: www.europetro.com. 13-14.

IADC World Drilling Conference, Paris, (713) 292-1945, (713) 292-1946 (fax); e-mail: info@iadc.org, website: www.iadc.org. 13-14.

PIRA Understanding Global Oil Markets Conference, London, 212-686-6808, 212-686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 13-14.

Asian Oil, Gas & Petrochemical Engineering Exhibition, Kuala Lumpur, +60 3 4041 0311, +60 3 4043 7241 (fax), e-mail:

oga@oesallworld.com, website: www.allworldexhibitions.com. 13-15.

GazChem Conference, Port of Spain, +44 20 7903 2444, +44 20 7903 2432 (fax), e-mail: conferences@crugroup.com, website: www.britishsulphurevents.com/Gazchem07_prog.htm. 17-20.

Newfoundland Ocean Industries Association Conference, St. John's, Newf., (709) 758-6610, (709) 758-6611 (fax), e-mail: noia@noianet.com, website: www.noianet.com. 18-22.

Offshore Newfoundland Petroleum Show, St. John's, Newf., (403) 209 3555, (403) 245-8649 (fax), website: www.petroleumshow.com. 19-20.

Brasil Offshore International Oil & Gas Trade Show & Conference, Macae, 55 11 3816 2227, 55 11 3816 2919 (fax), e-mail: contato@brasiloffshore.com, website: www.brasiloffshore.com. 19-22.

PIRA Scenario Planning Conference, Houston, 212-686-6808, 212-686-6628, e-mail: sales@pira.com. website: www.pira.com. 25.

Russia & CIS Refining & Petrochemicals Business Conference & Exhibition, Moscow, +44 (0) 20 7357 8394, e-mail: Conferences@EuroPetro.com, website: www.europetro.com. 25-26.

API Exploration and Production Standards Conference on Oilfield Equipment and Materials, San Francisco, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org. 25-29.

PIRA Understanding Global Oil Markets Conference, Houston, 212-686-6808, 212-686-6628 (fax), e-mail: sales@pira.com. website: www.pira.com. 26-27.

CERA East Meets West Executive Conference, Istanbul, (800) 597-4793, (617) 866-5992 (fax), e-mail: register@cera.com, website: www.cera.com. 26-28.

Power-Gen Europe Conference, Madrid, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.pennwell.com. 26-28.

Russian Petroleum Congress, Moscow, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com. 26-28.

Moscow International Oil & Gas Conference & Exhibition, Moscow, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com/og. 26-29.

JULY

IPAA OGIS, London, (202) 857-4722, (202) 857-4799 (fax), website: www.ipaa.org/meetings. 11.

Carbon Sequestration Development & Finance Summit, Houston, (818) 888-4444, website: www.infocastinc.com/sequest07.html. 11-13.

Oil Sands and Heavy Oil Technologies Conference & Exhibition, Calgary, Alta., (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.pennwellpetroleumgroup.com. 18-20.

Purvin & Gertz Annual Asia LPG Seminar, Singapore, (713) 236-0318, (713) 236-8490 (fax), e-mail: glrodriguez@purvingertz.com, website: www.purvingertz.com. 25-28.

West China International Oil & Gas Conference, Urumqi, Xinjiang, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com. 26-27.

International Petroleum & Petrochemical Exhibition, , Urumqi, Xinjiang, +44 (0) 207 596 5233, +44 (0) 207 596 5106 (fax), e-mail: oilgas@ite-exhibitions.com, website: www.ite-exhibitions.com. 26-28.

AUGUST

Coal-Gen Conference, Milwaukee, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.

Calendar

com, website: www.pennwell.com. 1-3.

Rocky Mountain Natural Gas Strategy Conference & Investment Form, Denver, (303) 861-0362, (303) 861-0373 (fax), e-mail: cogaconference@aol.com, website: www.coga.org. 13-15.

American Chemical Society National Meeting & Exposition, Boston, (202) 872-4600, (202) 872-4615 (fax), e-mail: natlmtgs@acs.org, website: www.acs.org. 19-23.

NAPE Summer Expo, Houston, (817) 847-7700, (817) 847-7703 (fax), e-mail: nape@landman.org, website: www.napeonline.com. 23-24.

IADC Well Control of the Americas Conference & Exhibition, Galveston, Tex., (713) 292-1945, (713) 292-1946 (fax); e-mail: info@iadc.org, website: www.iadc.org. 28-29.

SEPTEMBER

Brasil Subsea Conference & Exhibition, Rio de Janeiro, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.pennwellpetroleumgroup.com. 1.

SPE/EAGE Reservoir Characterization and Simulation Conference, Muscat, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 3-5.

Power-Gen Asia Conference, Bangkok, (918) 831-9160, (918) 831-9161 (fax), e-mail: registration@pennwell.com, website: www.pennwell.com. 4-6.

Offshore Europe Oil & Gas Conference and Exhibition, Aberdeen, +44 (0) 208 439 8890, +44 (0) 208 439 8897 (fax), e-mail: oe2007@spearhead.co.uk, website: www.offshore-europe.co.uk. 4-7.

Black Sea Oil & Gas Summit, Istanbul, +90 312 454 00 00-1412, +90 312 454 00 01, e-mail: bsogs2007@flaptour.com.tr, website: www.bsogs2007.org. 5-6.

Corrosion Solutions Conference, Sunriver, Ore., (541) 926-4211, ext. 6280, website: www.corrosionconference.com. 9-13.

PIRA Understanding Natural Gas Markets Conference, New York, 212-686-6808, 212-686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 10-11.

SPE Asia Pacific Health Safety Security Environment Conference, Bangkok, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 10-12.

Turbomachinery Symposium, Houston, (979) 845-7417 (979) 845-1835 (fax), e-mail: turbo@turbo-lab.tamu.edu, website: http://turbolab.tamu.edu. 10-13.

Oil Sands Trade Show & Conference, Fort McMurray, Alta., (403) 209-3555, (403) 245-8649 (fax), website: www.petroleumshow.com. 11-12.

AAPG Annual Eastern Meeting, Lexington, (859) 257-5500, ext. 173, website: www.esaapg07.org. 16-18.

United States Association for Energy Economics/IAEE North American Conference, Houston, (216) 464-2785, (216) 464-2768 (fax), website: www.usaee.org. 16-19.

Russia & CIS Petrochemicals & Gas Technology Conference & Exhibition, Moscow, +44 (0) 20 7357 8394, e-mail: Conference@EuroPetro.com, website: www.europetro.com. 17-18.

API Fall Refining and Equipment Standards Meeting, San Antonio, (202) 682-8000, (202) 682-8222 (fax), website: www.api.org. 17-19.

Russia & CIS Refining Technology Conference & Exhibition, Moscow, +44 (0) 20 7357 8394, e-mail: Conference@EuroPetro.com, website: www.europetro.com. 19-20.

IOGCC Annual Meeting, New Orleans, (405) 525-3556, (405) 525-3592 (fax), e-mail: iogcc@iogcc.state.ok.us, website: www.iogcc.state.ok.us. 23-25.

Society of Exploration Geophysicists (SEG) Annual Meeting, San Antonio,

(918) 497-5500, (918) 497-5557 (fax), e-mail: web@seg.org, website: www.seg.org. 23-28.

Russia & CIS Petrochemicals Technology Conference & Exhibition, Moscow, +44 (0) 20 7357 8394, e-mail: Conferences@EuroPetro.com, website: www.europetro.com. 25-26.

Annual Engineering & Construction Contracting Association Conference, Colorado Springs, Colo., (877) 484-3322, (713) 877-8130 (fax), e-mail: registration@ecc-association.org, website: www.ecc-association.org. 27-28.

Russia & CIS Refining Technology Conference & Exhibition, Moscow, +44 (0) 20 7357 8394, e-mail: Conferences@EuroPetro.com, website: www.europetro.com. 27-28.

OCTOBER

IPLOCA Convention, Sydney, +41 22 306 0230, e-mail: info@iploca.com, website: www.iploca.com. 1-5.

ISA EXPO, Houston, (919) 549-8411, (919) 549-8288 (fax) website: www.isa.org. 2-4.

Rio Pipeline Conference and Exposition, Rio de Janeiro, +55 21 2121 9080, e-mail: eventos@ibp.org.br, website: www.ibp.org.br. 2-4.

ISA EXPO, Houston, (919) 549-8411, (919) 549-8288 (fax) website: www.isa.org. 2-4.

GPA Rocky Mountain Annual Meeting, Denver, (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gasprocessors.com, website: www.gasprocessors.com. 3.

IFP Symposium The Capture and Geological Storage of CO2, Paris, +33 1 47 52 70 96 (fax), e-mail: patricia.fulgoni@ifp.fr, website: www.ifp.fr. 4-5.

IPAA OGIS West, San Francisco, (202) 857-4722, (202) 857-4799 (fax), website: www.ipaa.org/meetings. 7-9.

Annual European Autumn Gas Conference, Düsseldorf, +44 (0)20 8241 1912, +44 (0)20 8940 6211 (fax), e-mail: info@theeagc.com, website: www.theeagc.com. 9-10.

IADC Drilling HSE Europe Conference & Exhibition, Copenhagen, (713) 292-1945, (713) 292-1946 (fax); e-mail: info@iadc.org, website: www.iadc.org. 9-10.

Annual European Autumn Gas Conference, Düsseldorf, +44 (0)20 8241 1912, +44 (0)20 8940 6211 (fax), e-mail: info@theeagc.com, website: www.theeagc.com. 9-10.

NPRA Q&A and Technology Forum, Austin, (202) 457-0480, (202) 457-0486 (fax), e-mail: info@npra.org, website: www.npra.org. 9-12.

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

ERTC Petrochemical Conference, Brussels, 44 1737 365100, +44 1737 365101 (fax), e-mail: events@gtforum.com, website: www.gtforum.com. 15-17.

Oil Shale Symposium, Golden, Colo., (303) 384-2235, e-mail: jboak@mines.edu, website: www.mines.edu/outreach/cont_ed/oilshale. 15-19.

GPA Houston Annual Meeting, Kingwood, Tex., (918) 493-3872, (918) 493-3875 (fax), e-mail: pmirkin@gasprocessors.com, website: www.gasprocessors.com. 16.

PIRA Global Political Risk Conference, New York, 212-686-6808, 212-686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 17.

PIRA New York Annual Conference, New York, 212-686-6808, 212-686-6628 (fax), e-mail: sales@pira.com, website: www.pira.com. 18-19.

IPAA Annual Meeting, New Orleans, (202) 857-4722, (202) 857-4799 (fax), website: www.ipaa.org/meetings. 22-24.

SPE/IADC Middle East Drilling and Technology Conference, Cairo, (972) 952-9393, (972) 952-9435 (fax), e-mail: spedal@spe.org, website: www.spe.org. 22-24.

Speaking journally...

Steven Poruban
Senior Editor

It has been this OGJ editor's habit—well, at least since Jan. 10, 2001—to keep a journal at work. The practice began as a way to avoid misplacing important work-related information.

Before that date, vital data such as contacts' phone numbers, story ideas, print deadlines, and notes from staff meetings and interviews were written on anything handy. And since this information always attached itself to scrap pieces of paper or on pages of countless notepads, it was easily lost and, dare say, most times forgotten.

The mounting organizational challenge led to a decision to confine important work-related notes to a central place. Voilà! This editor's habit of keeping work journals was born.

I say "journals" because there are now 13 of these roughly 80-page books. Twelve have been filled, and the current one is close to being so. On each journal's black cover is the time period of the writings within—most hold about 6 months' worth of notes.

These notebooks have accompanied their owner to every conference, interview, and staff meeting attended over the last 6 years. The current journal is always within arm's reach, open on the desktop, every day.

Historical reference

Organizational advantages aside, what's most interesting about this method of record-keeping is the historical perspective gained by leafing through past journals and reading the various dated entries. This is where certain questions find their answers: What was happening 5 years ago in the oil and gas industry that was making headlines? Who was being interviewed and why? Which story ideas never made it to fruition? Which ideas did?

After recently rereading parts of these journals, certain entries stood out from others. One entry in particular jarred this editor's nerves and with them, some horrible memories. The date was Sept. 11, 2001, and the event was the succession of terrorist attacks on New York and Washington, DC.

Six years of journal-keeping, and counting.

Like most people, this editor was completely numbed by the events of that day and was unsure of what to do: Leave work? Stay? And accomplish what, exactly?

As the horrific story unfolded slowly throughout that day, OGJ staffers at the time were gaining an understanding of the day's events and had plans to report collectively on how industry would be affected by the attacks. The consolidated story would be published on OGJ Online, the real-time news area of which at that time was only a few months old.

Written in my journal under that infamous date were notes for an assignment given me by a senior editor: "Call London. Ask IPE president how markets will be affected by attacks. Taking any security precautions?"

Upon making the call to London and asking my questions—armed with nothing but a sick, hopeless feeling in the pit of my stomach—I recall being told in the nicest way possible that how the attacks would affect oil markets was "the furthest thing" from the then-International Petroleum Exchange president's mind.

I came away with nothing to contribute to the online story that day and remember leaving work feeling exhausted, emotionally and mentally. Looking back, this writer finds it amazing that all of these vivid memories come flooding back from a single note in a journal.

Other entries

Other entries, although not carrying quite the same emotional weight, are poignant.

These entries range from the pragmatic—"Jan. 18, 2001: Need to call Colo. Attn. Gen. office for photo of Gale Norton" (US secretary of the interior during 2001-06) and "Feb. 8, 2001: Start contacting analysts about 4Q/2000 earnings"—to the inquisitive—"Sept. 12, 2003: Ongoing story...How can US gas producers turn around production decline?"

These journals serve as a record—albeit a personal one—for industry events. For example, turn to the notes taken during the first week of May of every year and read the last 7 years of speaker coverage during the Offshore Technology Conference held every year in Houston at that time.

One of the most satisfying aspects of keeping a work journal, however, is crossing things off "to do" lists. Prime example: "June 6, 2007: Finish writing journally speaking for June 11 issue."

Check. ✦

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Editorial

Policy by the numbers

The making of energy and environmental policy has become a contest of numbers. Governments set measurable targets to boost consumption of fuels they like and to cut use of fuels they don't. They mandate reductions in emissions of greenhouse gases. They set goals for energy efficiency, variously defined. If based on careful analysis, the numbers to which governments commit their countries might yield sound policy. Usually, however, they just ooze out of politics.

Policy-making by the numbers comes naturally in the age of modern management, fundamental to which are the careful setting and vigorous pursuit of quantitative goals. The managerial perspective so strongly affects industrial-world thinking, in fact, that government programs tend not to be taken seriously unless latticed with numerical targets and deadlines. Governments, inclined as they are to govern, relish the business-school maxim at the core of systematic goal-setting: Whatever can be measured can be managed. With minor variation, this becomes a license for activism: What a government measures it inevitably tries to manage.

Pick a number

There's nothing inherently wrong with governmental goal-setting. The technique can be as effective in governance as it is in the management of businesses. But it has to be used effectively. It's not enough to just pick a number and call it law.

Yet arbitrary goal-setting has reemerged as a standard feature of energy and environmental policy-making. In politics, moreover, goals have become bargaining chips.

The US ethanol mandate is an example. The Energy Policy Act of 2005 mandated that 7.5 billion gal/year of ethanol be sold as fuel by 2012. This year President George W. Bush proposed that the requirement climb to 35 billion gal/year by 2017. This, he said, would serve his ambition to reduce gasoline use by 20% in 10 years in order to increase energy security and reduce emissions of greenhouse gases.

Can the US produce that much ethanol at reasonable cost? Would achieving the ethanol targets really deliver the supposed gasoline savings? What is special about a 20% reduction in gasoline consumption? How much economic growth might the country have to forgo to hit the target? How, in a free-market economy, does the government enforce volumetric sales mandates? Policy-making by the numbers evades questions like these.

In any event, final US ethanol targets will be determined by political deals in an election season. Enforcement will fall to federal agencies able to do little more than prorate mandated volumes over fuel suppliers against best guesses about future consumption. Grain and fuel prices will continue to climb.

This process is not uniquely American. The European Union seeks to replace 10% of the gasoline used in its member countries with biofuels by 2020. While the target isn't as aggressive as Bush's, it forces governments to act. And that, of course, is the point: action for the sake of governmental action, even if it's ill-considered and compelled by baseless numbers.

Responses to climate change slog through similar mire. That most early supporters of the Kyoto Protocol won't achieve their initial goals for greenhouse-gas emissions says something about validity of the goals if not about the whole approach. Yet Kyoto fans already are pushing for tougher standards in the next round of targets.

Before last week's meeting of the G8 nations in Germany, Bush proposed that the world's 15 largest sources of greenhouse gases set long-term targets for emission reductions. His step toward goal-setting in this area represented a major change of position. But to leaders of several European countries, it wasn't enough. It didn't arrive with numbers and deadlines already in place. And it strayed from the United Nations framework that bred the foundering Kyoto treaty. A fresh approach, whatever its merits, thus might die untried in deference to a scheme already shown not to work.

Managing the unmanageable

In too many energy and environmental issues, political goal-setting has displaced informed debate. Masquerading as seriousness of purpose, it makes governments try to manage unmanageable systems like markets and the climate. There are better ways to pursue energy and environmental values. They all begin with governmental self-restraint. ✦

Deep water, deep drilling stimulate Gulf of Mexico

Sam Fletcher
Senior Writer

The US Gulf of Mexico is one of three regions—including the North Sea and South China Sea—that together are expected to receive half of total offshore spending through 2011.

Total offshore expenditures will make up "the lion's share of spending on the upstream sector" that analysts at Douglas-Westwood Ltd. forecast will top $275 billion by 2011, up from $216 billion in 2006. Industry observers agree that expensive deepwater projects are "disproportionately increasing spending shares" in the Gulf of Mexico as well as other hot spots.

Exploration and production capital expenditures are "on the rise across the board" despite prospective volatility in natural gas prices, said analysts in the Houston office of Raymond James & Associates Inc. in mid-May.

Production rising

Oil production from the Gulf of Mexico is expected to increase to "a possible high" of 2.1 million b/d over the next 10 years, according to a report May 1 at the Offshore Technology Conference in Houston by the US Department of the Interior's Minerals Management Service (MMS). Natural gas production from the gulf is expected to recover from recent declines to a possible high of 8.3 bcfd over the next 3 years.

"The Gulf of Mexico is one of the largest single sources of oil and gas supply to the US market," said Lars Herbst, acting director of the MMS gulf regional office. "With the continued interest and activity in the deepwater area of the gulf, we anticipate that oil and gas production will continue to be strong with a large portion of the production coming from the projects in deeper water depths."

Oil production in the gulf increased steadily during 1991-2001, leveled off in 2003, and declined in 2004-05, partly due to damage to offshore and coastal facilities by Hurricane Ivan in 2004 and Hurricanes Katrina and Rita in 2005. Shallow-water production declined steadily after 1997 but was offset by increasing deepwater oil production during most of that time.

Gas production has followed a similar trend, but increased deepwater output didn't prevent an overall decline in 2006. MMS officials see gulf production being boosted by 16 new deepwater projects coming on stream by the end of this year. A major contributor to the increased gas production will be the start-up of the Independence Hub facility, through which gas is expected to start flowing in the second half of 2007 (OGJ, Apr. 23, 2007, pp. 57, 94).

Technology incubator

Deep water and deep reservoirs on the shelf have made the Gulf of Mexico an incubator of drilling and production technology.

"It all starts here," said Darrell Hollek, vice-president of Gulf of Mexico operations and development at Anadarko Petroleum Corp. "Technology is absolutely critical in getting into deeper water—seismic imaging, drilling deeper wells of 30,000-plus ft. Technology has advanced as much in the last 10 years as it did in the previous 30 years, and we continue to be dependent on advancements in technology to move our industry forward."

The MMS granted 30 new technol-

The Kelly Candies, one of three tugs, moves the Neptune TLP hull from Signal International LLC's dry dock in Port Arthur, Tex., for installation on Green Canyon Block 613 in the Gulf of Mexico. Photo from BHP Billiton Petroleum (Americas) Inc.

ogy approvals in 2006. "This set a record for the number of approvals for first-time use of technology in deep water," said Herbst. Examples of technology advancements that MMS approved for use on federal leases during 2006 include:

- A high-integrity pressure-protection system (HIPPS) that allows use of pipelines not rated for the well's full shut-in tubing pressure. Although not proposed for a specific development, MMS approved the general HIPPS concept last July.
- Use of preset polyester moorings for deepwater drilling rigs. One stipulation for allowing the use of polyester moorings traditionally has been that the polyester moorings may not come in contact with the sea floor. After studying the polyester moorings, MMS granted approval for preset moorings if inspected and tested every 6 months.
- Various forms of subsea boosting such as a subsea pump allowing enhanced oil recovery.
- The first ever use in the Gulf of Mexico of floating production, storage, and offloading (FPSO) vessels on deepwater development projects.

Two pending deepwater projects in the gulf have been approved for FPSOs. One is part of Petrobras America Inc.'s fast-track development plan for the Cascade-Chinook project. "Petrobras sees it as almost an early-production system," said Georgie MacFarlan, editor of Douglas-Westwood's world floating production vessels database. "Petrobras is considering ultimately replacing the proposed FPSO vessel for its Cascade and Chinook oil fields with a semisubmersible, spar, or TLP."

The other unit is the former "ice-class, roll-on, roll-off German ferry MV Karl Carstensk," which "has been stripped of its previous equipment and is now taking shape as a production vessel," MacFarlan said. The vessel's hull is undergoing conversion at the Viktor Lenac shipyard in Croatia. Integration aboard the floating production unit, to be named Helix Producer I, will take place when the vessel arrives at Ingleside, Tex., from Europe in March 2008. The vessel is scheduled to move to Phoenix field (renamed from Typhoon field) on Green Canyon Block 237 in May 2008, where it will start production in the third quarter.

Helix as operator plans to redevelop the old Typhoon field, formerly operated by Chevron, which ceased production after Hurricane Rita wiped out the tension-leg platform and left it upended with just the keel poking above the waterline in 2005.

Shallow vs. deep

Not all of the Gulf of Mexico is equally blessed with oil and gas prospects, of course. The relatively shallow waters of the Outer Continental Shelf in the western and central gulf, where the offshore industry was born in 1947, are a mature province where conventional discoveries are smaller and more quickly depleted.

The jack up rig count in the gulf declined from 155 in 2001 to 88 in April, with "78 marketed, 58 contracted, and more leaving," said James K. Wicklund, partner and chief investment officer for Spinnerhawk Capital Management, Dallas, at an offshore outlook conference in Houston. "Operators are shrinking in size," he said.

"The problem is that individual shelf wells are averaging about 4.5 bcf today, and we can get that from prolific Barnett shale wells [onshore in Texas] at a much lower cost," Wicklund said. "That has been the problem in the shallow gulf—the discovery size has continued shrinking at such a rate that with natural gas at about $7/Mcf, no well's economics can stand a very high rig cost before dooming the economics of the well. And it then doesn't matter if there is only one rig left in the gulf, if the well isn't economic due to size and gas prices, with the rig's day rate above a certain level, the well won't be drilled."

Wicklund told OGJ on May 29, "Some of the companies, such as Apache, bought fields and integrated operations in the gulf over the past few years and are continuing to drill up those fields. But the one or two-well discoveries don't have much of an impact on an E&P company's value like a big land position in a shale play would."

SCHEDULED RIG DELIVERIES

Table 1

	2006	2007	2008	2009	2010	Total
Jack ups	10	17	31	16	3	77
Semisubmersibles	0	1	12	17	7	37
Drillships	0	1	4	7	2	14
Total	**10**	**19**	**47**	**40**	**12**	**128**
Increase to current fleet, %						
Jack ups						19
Semisubmersibles						22
Drillships						37

Source: Spinnerhawk Capital Management

The deepwater gulf E&P market, on the other hand, "is fine and will continue to be so. It's not an issue; it's strong as dirt," Wicklund said. "There are 18 operators currently active in the deep Gulf of Mexico with some 118 deepwater projects on production and wells drilled in 10,000 ft of water and to 30,000 ft TD."

At MMS, Herbst said, "There's solid evidence in both leasing and exploration activities to confirm the oil and gas industry's continued interest and motivation to explore and develop the deepwater frontier in the Gulf of Mexico." The number of gulf tracts in 1,500-4,999 ft of water receiving bids during federal lease sales increased by 32% from 2005 to 2006. The number of tracts in 5,000-7,499 ft of water receiving bids grew by 29%.

Deepwater leases last year accounted for 70% of the oil and 40% of the natural gas produced in the Gulf of Mexico, said MMS officials. Oil and gas operators announced 12 deepwater discoveries in 2006, with the deepest in 7,600 ft of water. More than half of the active oil and gas leases in the gulf are in more than 1,000 ft of water, which MMS defines as deep water.

Last year, Chevron Corp. set a drilling depth record for the US gulf—34,189 ft—at Knotty Head, the deepest oil well drilled in the gulf in 3,500 ft of water. Partners include Anadarko, BHP Billiton, and Nexen Inc., each with 25% interest. The Big Foot and Knotty Head discoveries confirmed the extensive Middle to Lower Miocene play in the Mississippi fan foldbelt area. Chevron successfully completed a record-setting production test on the Jack No. 2 well at Walker Ridge Block 758 in the Gulf of Mexico. The Jack well was completed and tested in 7,000 ft of water at more than 20,000 ft under the sea floor, breaking Chevron's 2004 Tahiti well test record. The Jack No. 2 well was drilled to a TD of 28,175 ft.

The scarcity of urgently needed equipment is tied to short-term drivers that will normalize over time, Wicklund said.

Douglas-Westwood analysts warned, "Up to 2011 most sectors of the [global] offshore industry will continue to be equipment and people resource-constrained. Consequently, day rates will remain high, especially for capital assets such as high specification drilling rigs and other vessels. The experienced personnel needed to design, build, and operate drilling and production equipment will also command a growing premium."

Spotty rig market

As a drilling market, the Gulf of Mexico is spotty.

Of 128 offshore rigs—jack ups, semisubmersibles, and drillships—scheduled for delivery worldwide in 2006-10, Wicklund told OGJ, "virtually none, with the possible exception of a deepwater rig or two, are slated for the Gulf of Mexico."

In keeping with the weakened market for conventional drilling on the OCS, day rates for shallow-water rigs in the Gulf of Mexico "continue to bounce along the bottom," Raymond James analysts said. "Overall, we continue to believe the Gulf of Mexico shallow-water jack up market is to remain weak through the end of the first half of 2007, with firming forward natural gas prices and incremental second-half rig migration acting to support rate improvement into 2008."

Angeline M. Sedita, contract drilling analyst at Lehman Bros., said, "The Gulf of Mexico jack up market remains the weak link. We believe that three to five jack ups could leave the region in 2007." As jack ups move from the gulf to other markets, "a pickup in jack up rates later in the year is definitely a possibility (although not a foregone conclusion)," she said.

Wicklund acknowledged general speculation that day rates for jack up rigs will increase in the second half of 2007. "But it is a hope as much as anything," he said, "as they have been much softer than had been expected, but the feeling is fortified by the number of rigs leaving to work in other regions."

Pride International Inc. said Gulf of Mexico day rates for jack up rigs "appear to be stabilizing and may even increase modestly by late 2007-early 2008 as natural gas prices stabilize and more jack ups move out of those waters to other markets." Pride is also examining potential opportunities for its midwater semisubmersible fleet and was reported recently in contract negotiations for its Pride Mexico (2,650-ft, second generation), which recently completed a commitment with Petroleos Mexicanos (Pemex) off Mexico at a day rate in the high $40,000s.

Drilling companies and financial analysts report Mexico's jack up rig market has remained strong despite the weak market in the US gulf.

Pride International Inc. recently secured 1-year contracts for three jack ups to work for Pemex offshore Mexico at day rates of $97,500 each. That is "a compelling alternative to working in the [US sector of the gulf] at day rates of $60,000-70,000," Lehman Bros. said. "We believe that Mexico will continue to be a promising target market for gulf jack up rigs and possibly deep-

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water rigs as well."

Pride also is examining future deepwater opportunities with Pemex, which is tendering for three deepwater rigs—one unit with a water depth capability of 10,000 ft and two with water depth capability of 7,000 ft. Contracts would be for 5 years each, but only the first 2 years would be fixed-rate, with rates during the final 3 years to be indexed.

For the first time, GlobalSantaFe recently indicated a willingness to bid on potential assignments in Mexico for jack ups currently in the US gulf, Sedita reported recently. She said, "Pemex has proven to be a better client than many had feared, and the ongoing weakness in the gulf has likely made opportunities in Mexico more attractive." She added, "Hurricanes and insurance issues are not concerns in the Mexican portion of the gulf."

Hurricane season

Weather forecasters are again calling for an active hurricane season in the gulf this year. The 2007 hurricane season could produce as many as 17 storms, 5 of which could be major hurricanes. Meteorologists estimate a 74% chance of a major hurricane hitting the US this year. Meteorologists also warned of a possibly active hurricane season in 2006, but severe storms never materialized to threaten offshore production.

Still, the double jolt suffered by offshore producers and coastal refineries and other facilities when Hurricanes Katrina and Rita slammed into the central Gulf of Mexico just 35 days apart in 2005 left its mark on the industry. At a panel discussion during OTC, Allen J. Verret, executive director of the Offshore Operators Committee, urged companies to identify at-risk assets, assign priorities to the risks, and evaluate ways to reduce exposure to storms, such as installing facilities subsea. But even subsea operations are not totally safe, as was demonstrated by damage to pipelines in the gulf in 2005.

Allen S. Brown, associate editor of American Society of Mechanical Engineers Mechanical Engineer magazine, said in early May that 2-3% of gulf pipeline capacity was still down as a result of the 2005 storms. There were 655 pipelines reported damaged, including 142 with diameters of 10 in. or greater. Of the damaged pipelines, 216 were associated with platform damage, 13 were associated with third-party impact, 12 were displaced by currents, 72 were exposed, 142 were related to riser damage, 26 had crossing damage, and 173 were the result of other or unknown damage.

Frank Puskar, president of Energo Engineering Inc., Houston, said companies may need to increase deck elevation on new platforms and should be concerned about deck elevation of existing platforms. Of 120 platforms destroyed during Hurricanes Ivan in 2004 and Katrina and Rita in 2005, "60% had wave in the deck," he said. Platforms designed with modern American Petroleum Institute RP 2A guidelines with new design deck elevations had a "good chance of not being destroyed," he said.

In 2006, none of the 10 gulf storms, including five hurricanes, made landfall on the US Gulf Coast, and the offshore industry took advantage of that respite to make improvements to its operations and procedures, said API Pres. and Chief Executive Red Cavaney on May 30.

"Our industry's upstream sector continued to analyze and apply updated environmental data on how powerful storms affect conditions in the gulf," Cavaney said. "During the 2004 and 2005 hurricanes, waves were higher and winds were stronger than anticipated in deeper parts of the gulf." The revised wind and wave data prompted API to reassess its recommended practices (RPs) for gulf operations. It published three interim documents covering the operation and construction of both mobile offshore drilling units and fixed and floating production platforms.

A second edition of the RP for the mooring of mobile offshore drilling units was issued in 2007, incorporating updated data analysis. On May 30, API published three new interim documents, with final RPs expected next year. "API is hosting workshops on these new publications in New Orleans and Houston this July," Cavaney said.

To prepare for future severe storms, pipeline companies have installed onsite backup electric power generation capability, improved communications systems to support continued operations, and cooperated with vendors to preposition food, water, and transportation, as well as plan for other emergencies. ✦

Strategies: How two busy operators approach the gulf

Petrobras America Inc. and a segment of Anadarko Petroleum Corp., both of Houston, were among the top five companies with the highest number of accepted high bids of leases in Outer Continental Shelf Sale 200 in the Western Gulf of Mexico in August 2006. Petrobras America was at the top of that list with 34 accepted high bids for a total of $45,483,774. Kerr-McGee Oil & Gas Corp., since merged into Anadarko, was fifth and the only independent producer in the top five, with 25 accepted high bids totaling $15,390,478. MMS awarded 371 leases to the successful high bidders for a total $331,950,865 in Sale 200.

It was the biggest federal lease sale in the Western Gulf "in terms of number of bids submitted in the past 9 years and the best in 8 years for the amount of money bid," said Chris Oynes, Gulf of Mexico regional director, at the time of the sale. "The level of activity underscores the Gulf of Mexico's importance to domestic energy production and the

oil and gas industry's interest in expanding their deepwater operations."

This article examines the focus and strategies of the two firms—one a subsidiary of a national oil company and the other one of the largest independents in the US—in the Gulf of Mexico.

Anadarko

Anadarko budgeted $4 billion for its 2007 capital program and plans to spend 25% of it in the deepwater Gulf of Mexico.

In recent years, Anadarko and Kerr-McGee Corp. were frequently among the top firms with the highest number of accepted high bids in lease sales for the central and western gulf. Often one or the other was the only independent producer listed with various majors among the top five winning bidders in such sales. With the merger of Kerr-McGee into Anadarko last year and recent installation of Independence Hub, operated by Anadarko, the deep Gulf of Mexico is a major focal area for the firm.

"There's a lot of interest in the gulf. We've had a lot of success there," said Darrell Hollek, Anadarko's vice-president of Gulf of Mexico operations and development. The company's large holdings in the deepwater gulf make it "easy to continue" with the prospects of added success.

Anadarko's other major areas of operation include onshore US, particularly the Rocky Mountains, which will get 30% of this year's budget, and Algeria. The company also has production in China, a development project in Brazil, and exploration programs in several other countries. It has divested some noncore properties in the Gulf of Mexico and onshore US for a combined total of $10.5 billion after income taxes.

"The sale of our offshore assets is an example of how discoveries can add significant value quickly," said Hollek. "Looking at the business as a whole, it sometimes makes sense to monetize some assets earlier rather than later. We remain extremely flexible as to how to best monetize various assets."

At the end of 2006, the deepwater Gulf of Mexico accounted for 13% of Anadarko's US reserves, which made up 88% of its total proved reserves of 10.5 tcf of gas and 1.3 billion bbl of crude, condensate, and NGL. In the deep gulf, Anadarko owns an average 63% working interest in 777 blocks and has access to an additional 27 blocks through participation agreements.

Darrell Hollek
Anadarko vice-president of Gulf of Mexico operations and development—
"There's a lot of interest in the gulf. We've had a lot of success there."

Anadarko's exploration program in the Central and Western Gulf of Mexico focuses on the extensive Middle-to-Lower Miocene play in the foldbelt area and the developing Lower Tertiary play near the 2006 Kaskida discovery.

During 2006, Anadarko delineated the Tonga, Big Foot, and Knotty Head discoveries and had five additional discoveries: Kaskida, Power Play, Claymore, Caesar, and Mission Deep. The company expects to participate in four to six exploration wells and three to five delineation wells in the region in 2007.

Independence Hub

Development plans for the gas-processing Independence Hub semisubmersible production platform and a gas export pipeline in the eastern Gulf of Mexico were approved in 2004. Anadarko is operator of the facility, which can process 1 bcfd of gas from several ultradeepwater gas fields, including eight Anadarko field discoveries. Initial production will be from 15 wells; Anadarko has an interest in 14 of those wells. First production is expected in the second half of this year.

The Independence Hub water depth exceeds 8,000 ft, deepest of any offshore platform. The facility's gas-processing capacity is the largest in the gulf. The 20-in. steel catenary riser connecting the production platform to the Independence Trail gas pipeline ranks as the largest and deepest such riser ever installed. Beginning at Independence Hub on Mississippi Canyon Block 920, Independence Trail is also the deepest export pipeline installed to date. The 134-mile, 24-in. pipeline connects with Tennessee Gas Pipeline on West Delta Block 68.

Enterprise Field Services LLC announced Mar. 8 that the Independence Hub semi had been successfully installed. Independence Hub LLC, a venture of Enterprise (80%) and Helix Energy Solutions Group Inc. (20%), owns the facility. Besides Anadarko, the producers group includes Dominion Exploration & Production, Devon Energy Corp., Hydro Gulf of Mexico, and Murphy Oil Corp. The Independence Trail Natural Gas Pipeline is a wholly owned affiliate of Enterprise Products Partners LP.

Anadarko's leases

With 2.7 million net acres, Anadarko ranks among the gulf's top leaseholders. Anadarko utilizes a "hub and spoke infrastructure" while maintaining a controlling rig position in the Gulf of Mexico. In the first quarter of this year, it had five deepwater rigs under its operation.

Hollek expects the gulf to maintain its 20-25% share of Anadarko's total investment. He sees the deepwater gulf as "an area where we can make step changes" in strategy and technology through the development of ideas that eventually can be applied in other areas of the world.

The offshore industry is "not so

large anymore," Hollek said, "so it's not hard to keep up with the industry and technology." Although costs are rising, Anadarko "saw some of this coming" and was able to "get nine deepwater rigs under long-term contracts" before day rates started to climb.

Petrobras

Petroleo Brasileiro SA (Petrobras) began a push in the 1970s to reduce Brazil's dependence on foreign oil and became in the process a leading expert in deepwater exploration and production. Now it is applying that expertise in the Gulf of Mexico and other international areas.

In the 1970s, the state-owned company produced a mere 50,000 b/d of oil in Brazil from onshore and shallow-water operations. Output rose to 500,000 b/d in the mid-1980s as Petrobras began exploring deep waters.

"If it were not for deep waters, Petrobras would be just a 500,000-b/d oil company," said Joao Carlos Araujo Figueira, senior vice-president of upstream operations at Petrobras America Inc. in Houston.

Today, Petrobras is the world's seventh-largest publicly traded oil company, with global production of 2.3 million b/d of oil equivalent. Because of the company's pioneering deepwater work, Brazil currently produces enough oil domestically to meet its own demand. Petrobras has proved reserves of 15 billion boe, of which 1.27 billion boe is outside Brazil. Production in 2006 averaged 2.297 million boe/d, of which 2.054 million boe/d was in Brazil and 243,0000 boe/d were produced internationally, including the Gulf of Mexico.

Oil production alone amounted to 1.8 million b/d in 2006 and is expected to grow to 2.3 million b/d by 2011, with 500,000-600,000 b/d expected to come from international operations, Figueira said. In the gulf, Petrobras expects to be producing 20,000 boe/d, up from 16,000 boe/d at present. But gulf output could grow to 130,000 boe/d by 2013.

"These numbers are conservative," Figueira said. To achieve the production targets, Petrobras America has an investment plan of $4.5 billion for 2007-11.

Gulf experience

Petrobras has been involved in US exploration and production since 1987, when it acquired shares from Texaco Inc. in eight blocks of the Gulf of Mexico. In 2001, Petrobras America changed its strategy in the gulf, "attempting to achieve more focus and materiality while preserving the prudent approach of the past," the company said in a report. Its main goal was to take advantage of the deepwater expertise it developed off Brazil and to selectively build a portfolio of world-class exploration acreage in deep and ultradeep water and ultradeep drilling in shallower waters to secure meaningful medium-to-long-term production growth in the gulf and elsewhere, primarily off Nigeria and Angola.

Joao Carlos Araujo Figueira
Petrobras America Inc. senior vice-president of upstream operations—
"If it were not for deep waters, Petrobras would be just a 500,000 b/d oil company."

Petrobras America's current holdings off the US total 302 blocks in the Gulf of Mexico, including 121 leases (41 operated) in relatively shallow water of the Outer Continental Shelf, 180 in deep water (120 operated), and 1 onshore lease on the upper Texas Coast, not operated by Petrobras. It has interests in six producing fields.

Since 2002, Petrobras has participated in a series of ultradeep-water discoveries in the US sector of the gulf. The Cascade accumulation was discovered that year. Petrobras acquired other blocks and in 2003 made the Chinook and Saint Malo oil discoveries. By April 2004, it had participated in the discovery of natural gas in Coulomb North field, which went on production and in less than 3 months through adjacent infrastructure. Operated by Shell, Coulomb for a time held the world water-depth record for production, 2,031 m.

In 2004, the company acquired major deepwater exploration prospects through farmins in US waters and also explored for deep gas reservoirs in shallow water. Petrobras America later was successful bidder for 37 blocks off Corpus Christi, Tex., in 500-2,000 m of water. The company has identified at least three major prospects in the region. It operates the blocks with 100% interest.

Although generally regarded a mature area, the gulf is still a frontier in ultradeepwater exploration and drilling for deep gas on the shelf, said Alberto Guimaraes, president of Petrobras America Inc. in Houston. In ultradeep water, he said, drilling so far has been sparse. "We see ourselves as a member of a special and very restrictive club of those companies who can say, 'I have confidence in the technology I have to explore and to face this kind of risk.'"

In the gulf, Figueira said, "We have three areas where innovation is the name of the game." One region is the essentially mature conventional drilling areas in shelf waters where Petrobras is using its deep-drilling expertise to tap into deep gas deposits. "Below a given depth, it's a brand new province," Figueira said. With plenty of pipeline already in that area of the gulf, he said, "It's easy to monetize a gas discovery quickly and have an early cash inflow."

Then there are Corpus Christi, Padre

Island, and Mustang Island quadrants of the western gulf off South Texas, Petrobras is challenging a paradigm, in that Lower Tertiary reservoirs that occur onshore in South Texas and in ultradeep waters have not been found in the transitional shallower to deeper waters (650-2,300 ft) in between.

"We made an evaluation and came to the conclusion that earlier wells that were drilled in this area were not drilled deep enough," Figueira said. Other producers "drilled down to a given depth and found shale or a very shaley section," he said. "In general, we intend to drill deeper than 20,000 ft. That's the basic rationale that has driven the company to invest thereabouts." Petrobras has drilled one well in that general area. "It was not commercial, but we got some hints that encouraged ourselves to keep this area in our base data," Figueira said.

Petrobras' third "innovation area are the ultradeepwater prospects some 180 miles off the Louisiana coast with the Cascade and Chinook fields along the Walker Ridge area and the Coulomb North and St. Malo fields and other prospects where Petrobras can apply its deepwater expertise.

There is a fourth area 138 miles off Texas in the deep central gulf where in February Petrobras America began producing from the first well in the Cottonwood gas-condensate field on Garden Banks Block 244 in 670 m of water. It is the first deepwater field outside of Brazil that Petrobras, as operator, has developed and put into production. Production began at 40 MMcfd but soon increased to 70 MMcfd when a second well came on stream. Figueira describes that as an "area of continuation." He said, "Everything we have to do here is to improve data quality, particularly seismic, in order to have a better image of the prospect."

The gulf shelf areas off Texas and Louisiana "still need to be proved up," Figueira said. But Petrobras has production at Cottonwood and in the ultradeep water at Coulomb, operated by Shell Oil Co. Cascade, operated by Petrobras, and St. Malo, operated by Chevron. Those "are the first flowers we've been able to collect in this huge garden" of the Gulf of Mexico, Figueira said.

"We at Petrobras realize we have to look for two or three things in our internationalization process," Guimaraes said. "One is that we have developed some special technologies in the company that differentiate Petrobras among others. Any big company has some specialties, some special factors. Petrobras is not an exception. So in the process of going abroad we have decided what we have to do is not be like others but apply those things that make us different and special."

Alberto Guimaraes
Petrobras America Inc. president—
"We have developed some special technologies in the company that differentiate Petrobras among others."

Guimaraes said, "The second factor is to look for areas where we can apply successfully these technologies and specialties, and the Gulf of Mexico is just one of those regions. Right now we are developing a very good project in Nigeria where we are positioning ourselves in a very big scale and applying this same physical syntax." Moreover, he said, "We have decided from previous experience that our company for the size it has, for the capital it applies, and the type of projects that have been successful" is not a fit for small scale projects. "So we have to look for major projects."

Petrobras always has been quick to adopt new technology, from flexible pipe to subsea production to floating, production, storage, and offloading (FPSO) vessels. The company now is transferring technology developed in Brazil to the Gulf of Mexico. "It's not a new concept—it has been tested, fully audited, and proven in Brazil," Figueira said.

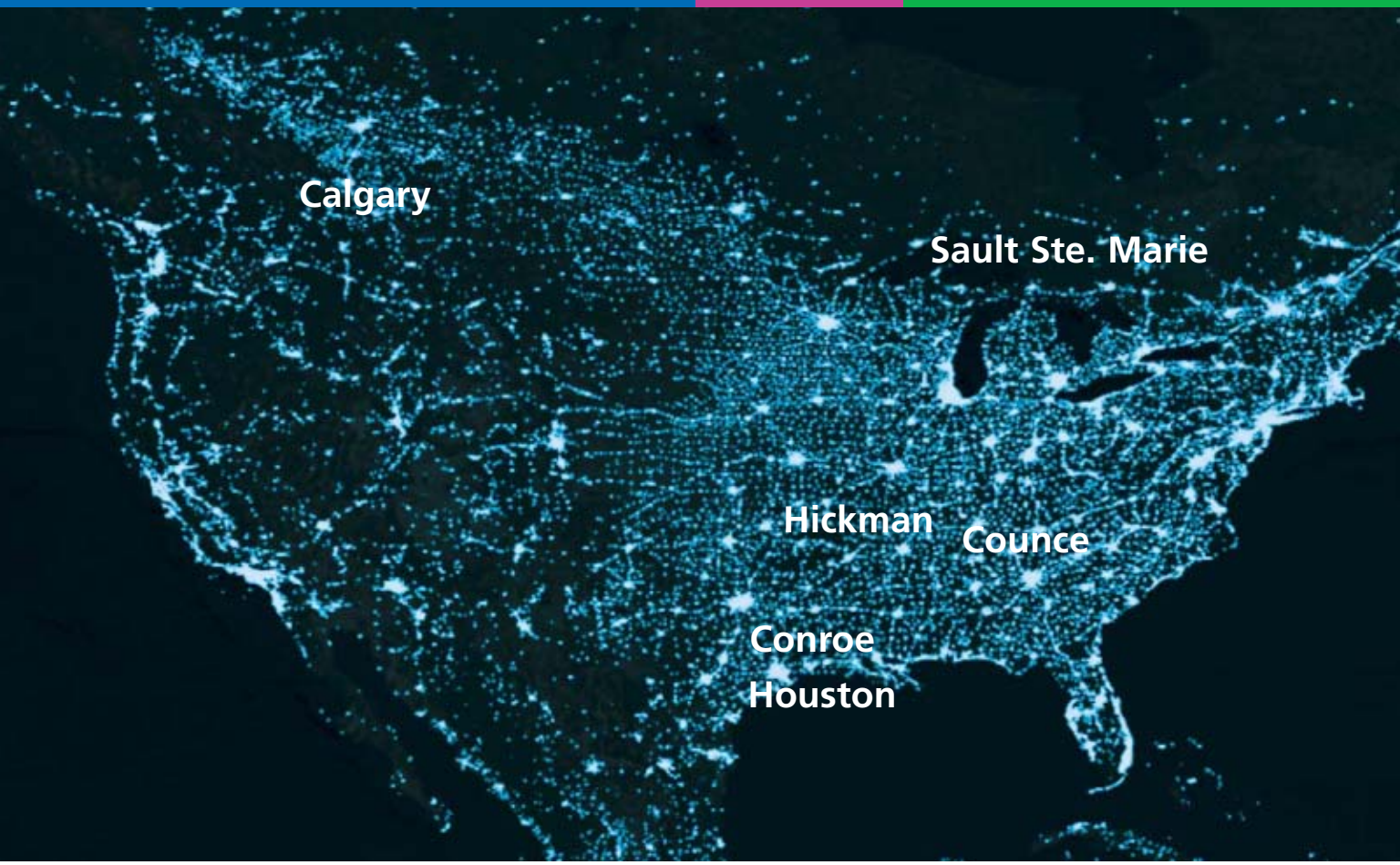
FPSO for the gulf

At the end of 2006, Petrobras' plan for subsea development of Cascade and Chinook fields was approved by the US Minerals Management Service, the first such plan ever to include an FPSO in the Gulf of Mexico. Petrobras has used FPSOs extensively in deep water off Brazil to reduce infrastructure costs and speed production to markets. There, it has 15 FPSOs in operation and 9 under construction.

In seeking MMS approval for the first FPSO in the Gulf of Mexico, Guimaraes cited another benefit—human and environmental safety. When a hurricane approaches, an FPSO can easily disconnect, move to safety, then return and reconnect once the storm has passed.

For the Cascade-Chinook project, Petrobras plans to start oil production in 2009 with the help of six technologies that are, in addition to the FPSO, new to the US sector of the Gulf of Mexico: a disconnectable turret buoy that allows the FPSO to move offsite during bad weather; crude transportation via shuttle tanker; free-standing hybrid risers; subsea electric submersible pumps; torpedo pile vertical loaded anchors; and polyester mooring systems.

The plan calls for installation of an FPSO in 7,000-9,000 ft of water, with at least two subsea wells in Cascade and one subsea well in Chinook, each drilled to 27,000 ft and tied back to the FPSO. Based on reservoir performance, the development plan could be expanded to include additional wells on each unit. Petrobras is operator with 50% of Cascade and 66.67% of Chinook. Devon Energy Corp. owns the remaining 50% of Cascade, and Total E&P USA Inc. owns 33.33% of Chinook. ✦



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GAO report shows US receives one of world's lowest oil, gas revenue takes

Nick Snow
Washington Correspondent

The US government receives one of the world's lowest government takes—revenue as a percentage of the value of production—from oil and gas produced from its lands, the US Government Accountability Office (GAO) said in a report issued June 1.

Although increasing oil and gas royalties on future leases would increase the US government's take, the congressional watchdog agency said, it might also reduce some taxes and other fees and could discourage some development and production.

GAO issued the report a few days before Congress was due to return from its Memorial Day recess to consider a broad range of oil and gas-related measures. These include provisions repealing parts of the 2005 Energy Policy Act, restricting uses of produced water, limiting federal oil royalty in-kind payments to Strategic Petroleum Reserve purchases, making oil product price manipulation a federal crime, mandating more-efficient government offices and motor fleets, increasing biofuel supplies, and bringing other alternative fuels to market more quickly (OGJ, May 28, 2007, p. 28; June 4, pp. 21, 26, and 28). Majority Leader Harry Reid (D-Nev.) and other Senate Democrats said May 23 that additional energy legislation could be considered during 2007.

GAO prepared its report in response to requests in January from Senate Energy and Natural Resources Committee Chairman Jeff Bingaman (D-NM), and three other US lawmakers. Its analysis from January through March examined studies conducted in 2006 that were completed before the US Minerals Management Service increased the royalty rate for future Gulf of Mexico deepwater leases.

Among the lowest

According to the report, five studies by various private sector entities collectively showed that the US received a lower take from production in the Gulf of Mexico than many foreign governments and states such as Colorado, Wyoming, Texas, Oklahoma, California, and Louisiana receive from oil and gas production on their acreage.

Other 2006 and prior year studies similarly show that the US consistently ranked low in government take compared with other governments. A study completed in 2006 for MMS showed that, of 31 fiscal systems analyzed, the US government's take in the Gulf of Mexico deepwater and shallow water "was lower than 29 and 26, respectively," GAO said.

In considering where and when to invest development dollars, oil and gas producers consider the government take, the size and availability of resources in the ground, labor and other costs of finding and developing those resources, costs of complying with environmental restrictions, and the stability of the fiscal system and the country in general.

"All else held equal, investment dollars will flow to regions in which the government take is relatively low, where there are large oil and gas deposits that can be developed at relatively low cost, and where the fiscal system and government are deemed to be relatively more stable," it continued.

On this basis, and with their relatively close proximity to domestic markets, US government deepwater tracts in the Gulf of Mexico are a favorable investment region for oil and gas producers, although high operating costs may deter some companies, the report said.

Lower overall gain

GAO said MMS expects that its recently announced increase in future deepwater Gulf lease royalty rates to 16.67% from 12.5% will increase revenue by $4.5 billion over 20 years but that this would be partially offset by $820 million of revenue lost from lower taxes and other fees and 5% less production.

"A lower royalty rate can encourage oil companies to pursue oil exploration and production and thereby provide an economic stimulus to oil-producing regions.

For example, according to an MMS study issued in 2006, as the industry expands output in the Gulf of Mexico, employment levels in all Gulf Coast states—including Alabama, Louisiana, Mississippi, and Texas—tend to rise to meet industry needs," GAO said in the report.

A healthy oil and gas industry is an essential part of a strategy to meet US energy needs while balancing environmental and climatic impacts, the agency maintains. This means the US market must be competitive in attracting oil and gas investment capital.

"Such development, however, should not mean that the American people forgo a competitive and fair rate of return from the extraction and sale of these natural resources, especially in light of the current and long-range fiscal challenges facing our nation. The potential trade-offs between higher revenue collections and higher oil production highlight the broader challenge of striking a balance between meeting the nation's energy needs and ensuring a fair rate of return for the American people from oil production on federally-leased lands and waters," it concluded. ✦

Brazil unveils growth program based on oil, gas

Peter Howard Wertheim
OGJ Correspondent

Energy projects included in the strategic plan of Brazil's state-owned Petroleo Brasileiro SA (Petrobras) are underpinning the country's new "Program for Accelerated Growth" (PAC), an economic expansion program outlined recently by the country's President Luiz Inacio Lula da Silva that is expected to be the lynchpin of his second term in office.

About 65% of PAC's energy infrastructure projects involve oil and gas, mostly in the southeastern states. Of these, 183 are already in Petrobras's strategic plan, representing $86 billion in Brazil-based investment through 2010. These include:

• The Rio de Janeiro State Petrochemical Complex (Comperj), a $10.5 billion project to process 150,000 b/d of heavy oil to produce diesel, ethane, propane, benzene, paraxylene, butadiene, polyethylene, polypropylene (PP), PET, PTA (primary material for making PET and polyester), ethylene glycol, and styrene. Construction is expected to begin in 2008.

• The Abreue Lima refinery in Pernambuco state, a $5 billion joint venture with Venezuela's Petroleos de Venezuela SA that is expected to break ground this year and, once online in 2012, to process 200,000 b/d of heavy oil and produce diesel, coke, naphtha, liquid petroleum gas, and bunker fuel.

• Two biofuels pipelines—an ethanol line from Goiás state to São Sebastião, São Paulo state port, and a line for both ethanol and biodiesel, to run from Cuiaba, Mato Grosso, to Paranagua in Paraná state.

• The gas production anticipation plan (Plangás), a $12.5 billion investment to increase natural gas production to 40 million cu m by yearend 2008 and to 55 million cu m by yearend 2010.

• New gas pipelines totaling 4,526 km.

• A slate of 120 new biofuels projects over the next 4 years to raise the country's ethanol output to 23.3 billion l. by 2010 and biodiesel production to 3.3 billion l. The projects break down as follows: ethanol, 77 new plants producing about 40% more ethanol than current production; biodiesel, 46 new plants to quadruple current production by 2010; and H-bio, a blend of vegetable oil and diesel: Petrobras will invest $71 million in four refineries in Minas Gerais, São Paulo, Paraná, and Rio Grande do Sul states.

President Lula made it clear that the PAC will only become viable with private sector participation.

UK energy strategy stresses efficiency, nuclear power

Uchenna Izundu
International Editor

Oil and gas from the UK North Sea will remain important in meeting the country's energy needs, the UK government confirmed in its long-awaited Energy White Paper on May 23, but it stressed that nuclear power may have a role in diversifying the energy mix.

According to the Energy White Paper, oil and gas is expected to rise to 80% of its primary energy supply by 2020 from 70% in 2006. Alistair Darling, the secretary of state for trade and industry, said the UK will ensure it has diverse suppliers and will fight for liberalized markets in Europe and internationally.

The government plans to triple the amount renewables will contribute to electric power generation by 2015 and has launched a 5-6-month study to clarify the future role of nuclear power stations.

Oil & Gas UK, the pan-industry body representing the UK oil and gas exploration and production industry, welcomed the government's views on domestic oil and gas in the energy mix.

Malcolm Webb, Oil & Gas UK's chief executive, said the economics of many offshore fields, new gas developments in particular, are becoming more challenging "given the current high operating and development costs and low gas price. It is therefore encouraging to hear the government emphasizing the importance of an appropriate fiscal and regulatory regime for our industry."

The next major source of oil and gas for the UK appears to be the West of Shetlands, which is estimated to hold around 17% of the UK's remaining oil and gas. "Currently, overall development costs are expected to be in the region of £4 billion, and the economics are sufficiently encouraging for the task force to consider more detailed technical and commercial assessment of specific options," the Energy White Paper stated.

Low-carbon initiatives

Greater energy efficiency and a secure, low-carbon energy mix for the long term were important themes in the paper, which the political opposition criticized for lacking substance and for indecisiveness on implementing a nuclear strategy. New nuclear power stations are unlikely to be built before the end of 2017 at the earliest, raising a potential shortfall in electric power supply earlier in the decade. The government said it would announce its decision on nuclear power at yearend. It wants to offer private energy companies the option of investing in new nuclear projects.

The government has proposed cutting carbon emissions by 23-33 million tonnes by 2020, stressing investment in new, low-carbon sources. "We want to lead in the development of carbon capture and storage," Darling said, adding that the government would strengthen the EU Emissions Trading Scheme to ensure a long-term market price for carbon.

Darling's announcement on carbon capture and storage sounded hollow when BP PLC revealed on May 23 that it would drop its carbon capture and storage project in Peterhead, Scotland, after the government delayed a competition offering subsidies until November, which BP said was too late for it to make a final investment decision.

However, it remains questionable whether energy policy can be fulfilled if the UK is struggling with a skills shortage with dwindling numbers of graduates in science, engineering, and technical careers.

Louise Kingham, chief executive of the Energy Institute, said: "A survey carried out last year by the EI revealed potential skills gaps in the energy industry in the next decade. Increased efforts are required to assess the problem, share best practice and knowledge between regions, and stimulate training activity, to avoid a skills shortage becoming a constraint on policy implementation."

The Energy White Paper was due to be published in March, but this was delayed after Greenpeace launched a legal challenge claiming that the government had not carried out its nuclear consultation process properly. ✦

COMPANY NEWS

Dominion sells assets in deals totaling $6.5 billion

Loews Corp. and XTO Energy Inc. agreed to buy certain oil and natural gas producing properties in two separate deals from Dominion Resources Inc. for a total of $6.5 billion.

In other recent company news:

• A federal district court in New Mexico ruled against the US Federal Trade Commission and set the stage for Giant Industries Inc. and Western Refining Inc. to merge, the two companies said in a joint announcement.

• OAO Gazprom will gradually buy a 50% stake in Belarus state pipeline company Beltransgaz for $2.5 billion by 2010, the company said. Beltransgaz delivers Russian gas to the European Union and supplies Russian gas within Belarus.

• Abu Dhabi National Energy Co. announced plans to buy Northrock Resources Ltd., a subsidiary of Pogo Producing Co., for $2 billion. The transaction marks Abu Dhabi National's entry into Canada.

Dominion assets bought

Loews, a conglomerate based in New York, will pay Dominion $4.025 billion for estimated proved reserves of 2.5 tcf of gas. XTO agreed to pay the Richmond, Va.-based electric and gas utility $2.5 billion for estimated proved reserves of 1 tcf of gas. The sales are expected to close in August.

Last year Dominion announced plans to divest its exploration and production operations except for 1 tcf of estimated proved reserves in the Appalachian basin (OGJ Online, Nov. 1, 2006).

Dominion has already offloaded certain assets this year. In April Eni Petroleum Co. Inc. agreed to buy Dominion's oil and gas interests in the Gulf of Mexico for $4.8 billion (OGJ Online, Apr. 30, 2007). In May Paramount Energy Trust and Baytex Energy Trust, both based in Calgary, made plans to buy Dominion's Canadian assets in two separate deals for a total of $583 million (OGJ Online, May 30, 2007).

Loews said it plans to buy Dominion's operations in the Permian basin in Texas, the Antrim shale in Michigan, and the Black Warrior basin in Alabama.

XTO plans to acquire 542,000 net acres of Dominion leases. About 235,000 acres are undeveloped property in the Rocky Mountains, the San Juan basin, and South Texas. The acquisition will add 200 MMcfd of gas production.

Dominion also announced a process to sell its Midcontinent operations, primarily in Oklahoma, that is scheduled to begin in July. As of Dec. 31, 2006, these operations had estimated proved reserves of 780 bcf and probable reserves of 435 bcf. Last year's average production was 120 MMcfd.

XTO said 64% of the reserves that it is buying are proved developed and about 95% are gas.

Anticipated development costs for proved undeveloped reserves are $1.50/Mcf, and XTO plans to spend $200 million on these properties in 2007. The Fort Worth company said it will operate 70% of these properties.

Bob R. Simpson, XTO chairman and chief executive officer, said the company increased its production growth guidance in 2007 to 15%, up from 10% as a result of the acquisition. XTO's initial production growth target for 2008 is 15%.

In the Rocky Mountains, XTO is acquiring 810 bcf of proved reserves and 326,000 net acres of leaseholds, primarily in Utah's Uinta basin. About 60% of that is developed. Net production is 26 MMcfd.

Assets include Natural Buttes gas field, Drunkards Wash coalbed methane field, and properties in the San Juan basin. XTO also is gaining entry into Jonah field in Wyoming.

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Plan today to join us this year down in Galveston as we continue our quest for operational excellence in planning and developing of our offshore exploration and production resources amid a sea of challenges.

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PERSONNEL MOVES AND PROMOTIONS

BP Refining names R&M chief executive

BP PLC has appointed **Iain Conn** chief executive of BP's refining and marketing business, effective June 1. He succeeds **John Manzoni**, who will retire Aug. 31 after 24 years of service.

Conn will retain regional responsibility for Europe, Southern Africa, and Asia Pacific.

Prior to his appointment, he served as an executive director of BP with functional responsibility for safety and operations, technology, marketing, human resources, information technology, procurement, and supply chain management. He had regional responsibility for Europe, Africa, Middle East, Russia, the Caspian Sea area, and Asia-Pacific.

He has several years of refining and marketing experience, the most recent from 2000-02 when he was responsible for marketing operations in Europe and for the integration of Veba Oel into BP. He was named chief executive of BP's petrochemicals business in 2002.

Conn joined BP in 1986 and has held various positions in exploration and production and oil trading.

Other moves

Whiting Petroleum Corp., Denver, has promoted several members of its operations team.

The company named **James T. Brown** senior vice-president. Brown joined Whiting in 1995 as a consulting engineer and later served as vice-president, operations. He has more than 30 years of oil and gas industry experience, including engineering positions with Shell Oil Co. and BP PLC.

Rick A. Ross was named vice-president, operations-Denver. Ross has been with the company since 1999 and has served as operations manager-Rocky Mountains. He has more than 25 years of industry experience, including engineering positions at Amoco Corp.

John A. D'Hooge was promoted to operations manager-Central Rockies. D'Hooge joined the company in 1998 as a consulting engineer. He has more than 30 years of industry experience, including engineering positions with Conoco Inc., Enstar Petroleum Co., and Berenergy Corp.

Brent A. Miller was promoted to operations manager-Northern Rockies. Miller has been with the company since July 2000 and served as staff operations engineer-Rocky Mountains. He has more than 28 years of industry experience, including engineering positions as a consultant and with Amoco.

The Interstate Oil & Gas Compact Commission has named Alaska Gov. **Sarah Palin** as its 2007-08 chair-elect, effective in September, when IOGCC will hold its annual meeting in New Orleans.

Palin later will become chairman of the commission during its 2008 annual meeting in Santa Fe, NM.

IOGCC comprises the governors of 30 member and seven associate states and promotes the conservation and efficient recovery of US oil and gas resources while protecting health, safety, and the environment.

In south Texas, XTO is acquiring 250 bcf of proved reserves and 216,000 net acres of leasehold, of which 50% is developed. Net production is 74 MMcfd. Production is primarily derived from the Wilcox Trend. The acquisition also provides production in the Frio and Vicksburg sand formations along the Gulf Coast.

Giant-Western merger cleared

In a May 29 order, US District Judge James O. Browning denied FTC's request for a preliminary injunction and dissolved an Apr. 13 temporary restraining order blocking the proposed combination.

"After analyzing the evidence the parties submitted concerning the relevant product market, the relevant geographic market, and the proposed merger's probable effect on competition in those markets, the court has determined that the order is not likely to create anticompetitive effects," Browning said.

He said FTC did not establish it would be able to prove that the merger would violate Section 7 of the Clayton Antitrust Act if the federal agency moved the matter to an administrative proceeding. "Specifically, the FTC has not convinced the court that there is a substantial likelihood it will prove the acquisition will result in a significant lessening of competition," Browning wrote.

Paul Foster, Western Refining's president and chief executive officer, said the court's ruling affirms that the merger "is procompetitive and provides important benefits to the companies' stakeholders, including our customers, shareholders, and employees."

FTC is appealing the decision, a spokesman said on May 30. The companies said in order to ensure an orderly process to a May 31 closing, they agreed with FTC not to close the merger before midday (MDT) on that day, but would feel free to do so after that time without a ruling from either the 10th Circuit Court of Appeals or US District Court.

Gazprom-Beltransgaz deal

According to the agreement signed by Gazprom and the Belarus state property committee, Gazprom will buy a 12.5% share in the company in four stages during 2007-10.

The contract, which took 13 years to finalize, strengthens Gazprom's grip over gas networks to the west and fol-

lows a major proposal agreed by Russia, Turkmenistan, and Kazakhstan more than a week ago to expand oil deliveries out of Central Asia via Russia, which has threatened plans by western governments to develop alternative supply routes outside of Russia (OGJ Online, May 14, 2007).

Beltransgaz must hold a meeting to elect a supervisory company after it has transferred the first 12.5% of the company to Gazprom.

Underpinning this agreement is the companies' pledge in December 2006 to set up a joint gas transmission venture to supply and transport gas across Belarus. In 2007 Gazprom will supply 21.8 billion cu m of gas to Belarus for $100/million cu m. The rise in prices to market rates for Belarus has seriously strained relations between the two countries and in turn, affected oil and gas supplies to Europe, prompting fears there about Russia as a reliable energy supplier.

ADNEC to buy Northrock

Abu Dhabi National's acquisition of Northrock is expected to close during the third quarter, pending regulatory approvals.

Based in Calgary, Northrock has operations in Alberta, Saskatchewan, and the Northwest Territories. It currently produces 29,000 boe/d. For yearend 2006, Northrock reported estimated proved reserves of 706 bcf of gas equivalent.

Northrock's production is 51% oil and its reserves are 55% oil, said Pogo. The Houston company is in the process of selling its noncore assets. Pogo said it is continuing to explore strategic alternatives, which could include a possible sale of the company.

Pogo acquired Northrock from Unocal Corp. for $1.8 billion in 2005 (OGJ, July 18, 2005, p. 30).

Abu Dhabi National is a global energy conglomerate with investments in power generation, renewable energy, upstream oil and gas operations, pipelines, services, and structured finance projects. ✦

WATCHING THE WORLD

Eric Watkins, Senior Correspondent

Of chopsticks and ethanol

Is the oil and gas industry shaking? Maybe not, but Iowa corn growers could be doing so after billionaire investor George Soros last week called on the US and Europe to drop tariffs on imports of Brazilian ethanol. Indeed, Soros said major investment to ramp up Brazil's ethanol production is at risk unless the US and Europe cut tariffs on imported ethanol.

"Unless the markets of the world are opened up, you probably have too much production coming on line," Soros said at Brazil's premier annual gathering of ethanol producers.

It's no surprise that Soros would say such things, given the fact that he has joined Brazilian investors in a $900 million plan to buy sugarcane land and build ethanol distilleries in western Brazil.

High tariffs

That's why he's concerned about the US, which levies a 54¢/gal tariff on Brazilian ethanol, while the European Union places a €0.19/l. tariff on the stuff—nearly four times as high.

That's also why Soros is concerned about a potential glut on the market, especially as Brazil is harvesting a sugarcane crop that is estimated to produce a record 5.3 billion gal of ethanol. As a result, Brazil this year is expected to equal or surpass last year's ethanol export record of 898 million gal.

Soros is not alone in seeking reduced tariffs for Brazil's ethanol. Last month, Sweden announced plans to pressure the regulatory arm of the EU to eliminate its import tariff on Brazilian ethanol, according to a report in Brazil's Valor Economico newspaper.

According to the Swedish National Board of Trade, Brazilian ethanol is competitive with world oil prices at €22($29.87)/bbl, compared to US corn-based ethanol which is competitive at €34($46.16)/bbl of oil. Swedish grain-based ethanol is only competitive with world oil prices at around €76($103.19)/bbl of oil, Valor reported. Of course, a Brazilian newspaper would probably highlight such remarks, wouldn't it?

Chop, chop

We wonder how much support either Soros or Valor would give to a recent study conducted in Japan on the production of ethanol from a variety of feedstocks–not just sugar.

A research team at the Tokyo University of Agriculture and Technology has developed an easy way to dissolve cellulose, the fibrous component of plants that is present in vast quantities but notoriously difficult to dissolve. The team's success promises to make it much easier to utilize wood scrap, weeds, and other forms of biomass as raw materials for the synthesis of ethanol.

We like the idea of a diversified feedstock for ethanol, instead of the more restricted source of supply that Soros and the Brazilians are calling for. We believe in a diversified approach, and we especially like the fact that the Japanese research group will next work to develop an ionic liquid that can dissolve solid substances like disposable chopsticks. ✦

WCSB STRUCTURAL DOMAINS—2

Massive rock ploughs formed structures in western Canada

J.H.N. *Wennekers*
Consulting Geologist
Calgary

This second of four parts on the formation and potential of the structured belt of the Western Canada Sedimentary basin begins with discussion of how the structures formed.

The belt mainly includes rocks of sedimentary origin in sequences of hard and soft layers of varying thicknesses. Mechanical properties of individual layers and of the entire package determine how the sequence will deform under specific stress conditions.

Stress causes deformation, and structures are born. Stress results in translation (displacement along faults), rotation (formation of folds), and strain (shape change). Each structure might be expressed by two 3D ellipsoids—stress and strain.

The first includes three active forces: sigma 1, 2, and 3, directed along x, y, or z axes and pointing to the intersection point of the three axes. When each of these forces is not opposed by an equal force, deformation (translation, folding, and strain) occurs.

The force sigma 1 is always the maximum force, sigma 2 the intermediate force, and sigma 3 the minimum force. The result of these three acting forces is strain, which might be represented by a second 3D ellipsoid. It shows the most likely shape changes (volumetric or distortional), including faults, folds, and fractures associated with the stress ellipsoid.

Strain is a function of the mechanical properties of rocks: Elastic, viscous, or plastic, respectively, signifying: No permanent deformation, permanent deformation, and stress-determined permanent deformation. These two ellipsoids more often than not do not have the same x, y, and z axes.

Fractures

Both 3D stress and strain ellipsoids define specific natural zones of mechanical failure, rock fractures, and faults in rocks subjected to stress (Figs. 8 and 9).

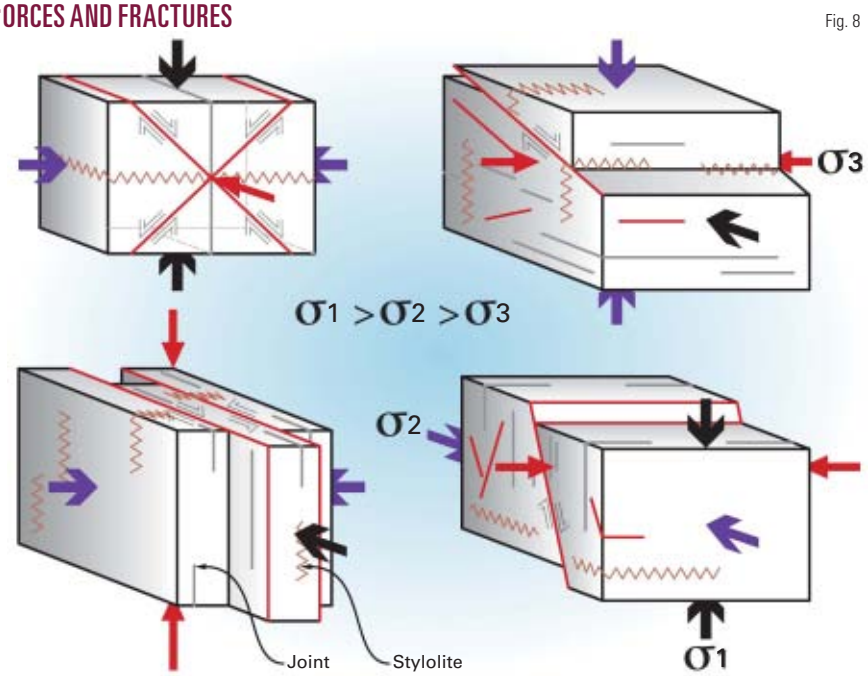
These zones are many: Fractures (Andersonian descriptive modes 1, 2, 3, and antimode 1, Fig. 10), joints, (master, cross, strike parallel, cross-strike, contained, pinnate, and tail), faults, fault zones, deformation bands, compaction bands, stylolites (pressure enhanced cone-in-cone dissolution), slickolites (surfaces of shear displacement, shortening, and dissolution), induced fractures, and fractures formed by massive reduction of overburden pressure, possibly changing sigma 1 vertical to sigma 1 horizontal, resulting in expansion of the rock volume and the opening of fractures.

The pressure enhanced cone-in-cone dissolution of rock may remove great percentages of the original thickness of rock units.

In the sedimentary section, brittle deformation occurred. Movement was mainly along reverse/thrust faults in the W, vertical

FORCES AND FRACTURES

Fig. 8



strike-slip faults in the E, including those penetrating upward from within the basement and others, vertical and striking parallel to the basement ones, and confined to the sedimentary section, normal faults, squeeze faults, horizontal shear faults, and associated flower folds (see seismic transects ST 1-15 in Part 3).

There are also extension fractures (movement perpendicular to fracture surface), and shear fractures (movement parallel to fracture surface). Fractures and faults form when stresses exceed rock fracture strength and displacements range from macroscopic to microscopic. Historically, it was thought that fracture strength depended on lithology and overburden pressure.

To date, it is known that the overburden pressure is only one component of many that form fractures, such as pore pressure, stress dissolutions, chemical changes, rock mineralogy, and grain size, to name a few.

When available cores are not studied and the position of stylolites in the cores is not determined, one will be hard pressed to know what the actual orientations of stress ellipsoids and their three sigma stresses were. This means it is impossible to form an opinion on the 3D position of the strain ellipsoid and its three fracture directions. Ergo, one cannot predict the locations of fractures or where to drill a structure to intersect open fractures.

Thrusts

In the structured belt, thrusts were created in reverse-faulting/thrust stress regimes (sigma 1 horizontal) with the allochthon in the W acting as the main engine.

Rollovers/leading edges of thrusts are the main drilling targets. Their curvatures are important to assess fracture presence and enhancement of potential reservoir rock. Their relative age should also be assessed to determine availability of open fractures.

Strike-slip faults, parallel with structure trends and at angles to them, add fractures and enhance reservoir quality. In drilling a leading edge rollover, one might wish to assess the strike-slip component of that structure and drill into it to achieve maximum reservoir enhancement.

To date, many geologists and geophysicists commonly accept that multiple thrust structures are formed by one thrust having been overridden by a younger one, which in turn is overridden by another even younger thrust. This is the multiplex thrust structure. In it, the oldest thrust is the deepest and the youngest thrust is the shallowest structure.

Detailed structural analyses for this article demonstrate the reverse to be true. Most deep thrusts are younger than the overlying shallower ones. Furthermore, the more easterly the occurrence of the thrust the younger it is. It all comes down to rock plough effects: massive rock blades that ploughed easterly and moved immense volumes of rock.

Seismic transects ST 1-15 (Part 3 of this article) and Fig. 11 define the rock ploughs' origin through time until all thrusting ceased.

The McConnell Thrust is a good example of a massive rock plough (see photo, p. 40). This thrust (500+ miles long) is a gigantic composite thrust. On it, an entire WCSB sedimentary section moved from W to E on top of a similar section farther E. Due to erosion, it is not known how far this thrust moved E.

Compression and overburden pressure competed to be the larger force. The overridden section was pushed E, and under the enormous compression and overburden pressures broke in many parallel gas-bearing thrusts. Only the easternmost thrusts have rollovers at the leading edges. The thrusts beneath the McConnell Thrust are youngest in the E.

Folds

In addition to fractures and faults, folds are abundant throughout the structured belt (ST 1-15).

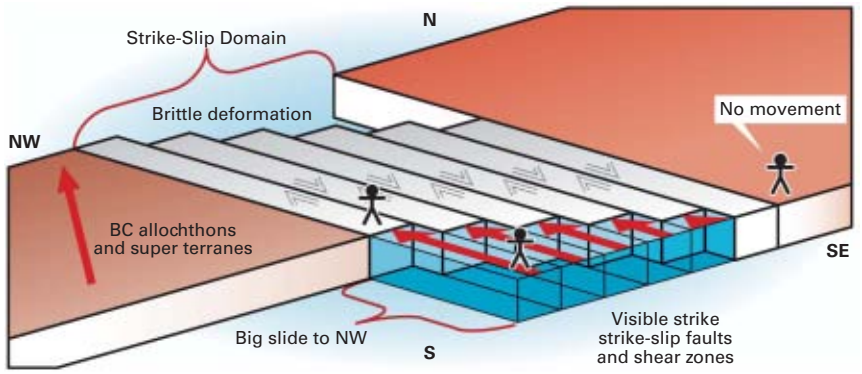
There are folds associated with thrust fault displacement and with sigma 1 force directed parallel to bedding, resulting in detachment, fault-propagation, harmonic, and gravity sliding disharmonic folds. There are also symmetric and asymmetric, recumbent, inclined, upright, cylindrical, noncylindrical, and isoclinal folds.

Many folds are riddled with all types of fractures. Predicting the occurrences of such fractures in deep-seated folds is the most difficult part of structural geology. This is as difficult as predicting the shape of the structures and pinpointing their locations at depth.

Successfully exploring the structures is more often than not a game of chance, despite chance of success analyses. Many deep folds with over 30° dipping front and back limbs are impossible to seismically image. Energy bounces off these dips and creates ghost impedance responses. Frequently,

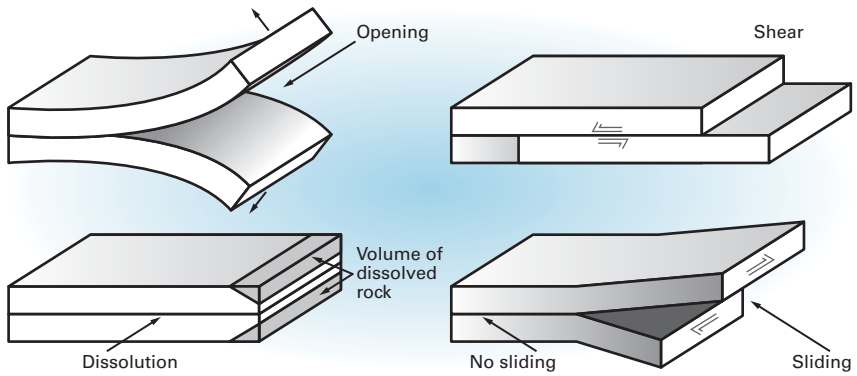
HOW STRIKE-SLIP FAULT-BOUNDED FAULT BLOCKS MOVED

Fig. 9



FRACTURES MODE 1, 2, 3, AND ANTIMODE 1

Fig. 10



dipmeter readings are not supported by seismic data—folds simply do not show up.

Detached rock bodies

The structured belt contains similar structures in its Alberta and British Columbia portions.

In the first, thick carbonate sections overlain by clastics were deformed into huge thrusts, extending hundreds of miles along strike. In the British Columbia portion an alternating sequence of carbonates and shale gave rise to numerous smaller shingled thrusts separated by detachment zones.

There are six regional extensive "horizontal detachment zones," mainly in shale sequences, >½-mile to 1 mile vertically apart. Two such surfaces enclose a rock body—the detached body. In total, there are five such rock bodies: The Cambro-Ordovician, Silurian/Devonian, Mississippian, Permian, and Triassic rock bodies (ST 12 and 13, Part 3) each >½ to 1 mile thick. A complex structured post-Triassic section (>2 miles thick) is present).

The detachment zones correspond with regional unconformities, marking periods of major structural upheaval. Structures are complex, and complexity was increased by regional shear manifested as strike-slip faults, shear zones, and flower folds.

Historically, the many thrusts were thought to be overthrusts that caused the W-E shortening of the sedimentary section. Compression from the W formed the thrusts. In this article, it is demonstrated that regional N to NW shear (including intense and widespread strike-slip faulting) had an enormous impact on the formation of structure and accumulation of hydrocarbons. This shear (Type I) was caused by a collision between a large landmass and the North American continent. It deformed, intensely in places, basement and overlying sedimentary section. In fact, shear and compression acted simultaneously, and numerous complex structures were formed.

Within the sedimentary section, subhorizontal shear (Type II) occurred between the basement and all above described detached rock bodies. The basement moved farther N-NW than the Cambro-Ordovician detached body, which moved farther N-NW than the Silurian/Devonian detached body, which in turn moved farther N-NW than the Mississippian detached body, and so on. It is not difficult to imagine the incredibly complex structures that formed by simultaneous multiple structural overprinting.

In addition to subhorizontal shear, the structured belt was subjected to NE-SW and W-E directed shear (Type III) in subvertical zones and strike-slip faults. This happened during their easterly movement. Internally the thrust bodies and detachment bodies were subjected to shear in the direction of their movement.

It is likely these shear zones and strike-slip fault zones enhanced reservoir quality in zones perpendicular to the strike of the structured belt. More important, these shear zones were the conduits for gas generated at great depths in the structured belt. This gas filled shallower structures.

The first detachment zone is the top of the regional basement. It is the gliding surface for the overlying shale section. In places, the basement supports large early (Cambrian-Ordovician) carbonate buildups up to 1 mile thick. One is exposed in the NE British Columbian portion of the structured belt. Others are suggested by seismic and structural evidence. These are deep drilling HPHT exploration targets. Possibly 5+ such buildups exist.

The second detachment zone is in the regional basal Cambrian-Ordovician section in a thick shale section. It deformed into a series of parallel NW-trending anticlines (shear boudinage) flat at the bottom and anticlinal at the top (ST 12 and 13). These folds have vertical axial planes, indicating vertical shear played a major role in their formation.

Hinge lines (fold axes) extend over hundreds of miles, undulate, and have individual apexes some 3-5 miles apart. Sometimes one fold splits into two en-echelon folds due to strike-slip shear parallel to the compressional fold axes. Going E, anticlines progressively lose amplitude and gradually go over into the layer cake of the Plains Domain.

This is the area where flanks of the shale cored anticlines exhibit steeply dipping zones. These penetrate the overlying section, cut through the shallower detachment zones, and create structure reversals (anticline to syncline and vice versa) in ascending order.

Resting on the shale anticlines are Upper Devonian carbonates. Numerous four-way closed rollover structures in these carbonates remain undrilled at depths greater than 3.5 miles. It is estimated that some 300 major rollover Devonian Wabamun targets remain undrilled.

The third detachment zone is

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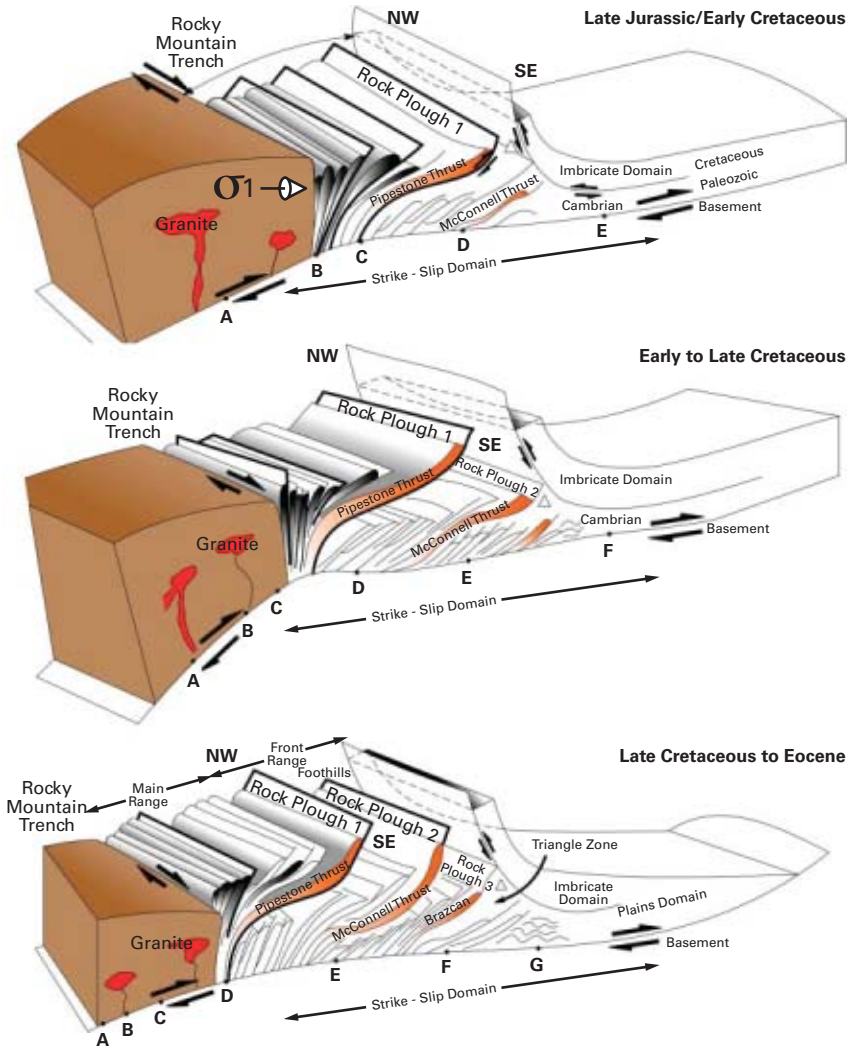
ROCK PLOUGHS (1 TO 3) OF THE STRUCTURED BELT*

Fig. 11



*Note the east advance of the sedimentary section over the basement.

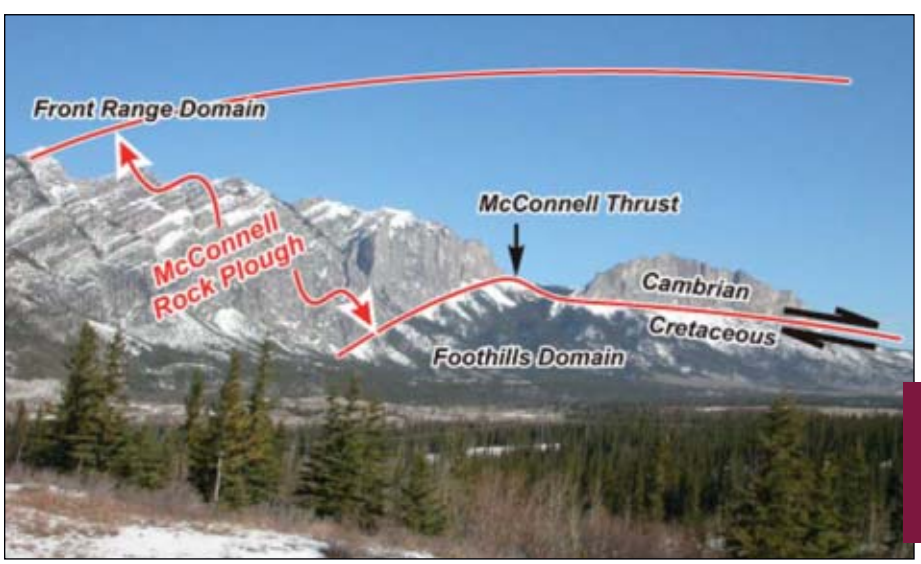
between Devonian and Mississippian carbonates. It is difficult to recognize as it coincides with a major unconformity surface. In some cases, though, numerous E thrusts support four-way closed Mississippian rollovers.

Mississippian structures vary greatly from large elongated four-way closed rollovers to small thrusted homoclines along the strike of the structured belt. It is estimated that some 400 undrilled Mississippian structures locate between detachment zones two and three.

The fourth detachment zone is between Mississippian and Permian carbonates. It coincides with a seismically mappable regional stratigraphic and structural unconformity. Extensive changes in structural attitude mark this detachment. There are numerous undrilled small structures just below this detachment. Above it, many structures contain Permian reservoirs. All are regionally bound upward by the fourth detachment (between Permian and Triassic strata).

"Permian structures" are numerous and vary in amplitude, size; four-way closed rollovers, thrust faults, and strike-slip shear modified structures. Historically the Permian carbonate play was small, but recently Talisman Energy has proven a new and exciting gas play at Sukunka/Monkman that might increase in significance as drilling progresses. It is estimated there are some 200 undrilled Permian targets in the structured belt.

The fifth detachment zone is between Permian and Triassic strata. Triassic carbonates above this zone are found in large disharmonic folds with steep to vertical E-facing forelimbs (hanging

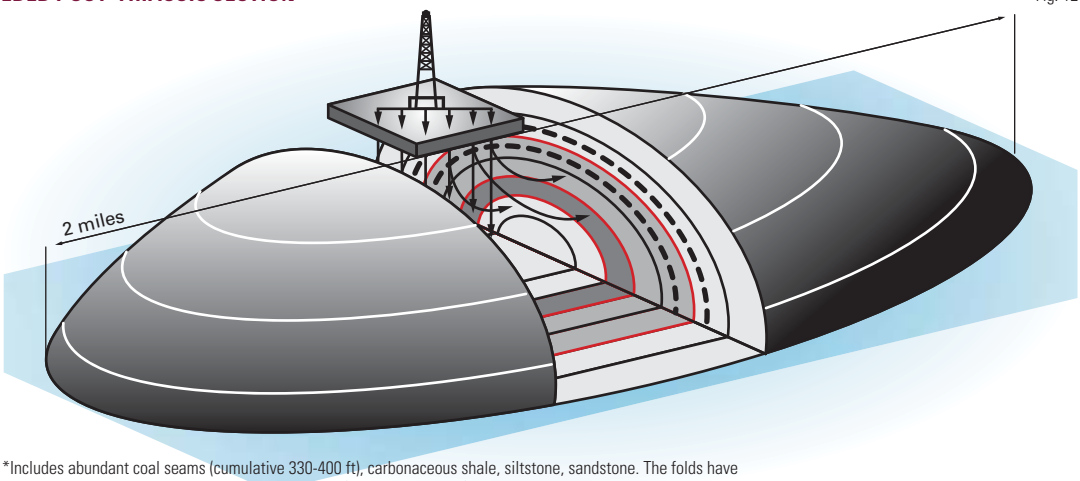


Mount McConnell, near Banff, Alta., is one of a series of rock ploughs that formed the structured belt.

walls) and gently W-dipping backlimbs (footwalls). Sometimes the folds change to thrust faults with heavily fractured carbonates in rollovers. Reservoir communication over distances greater than 3 miles is common in the hingeline portions of the anticlines. There are an estimated 300 Triassic structures to be drilled.

FOLDED POST-TRIASSIC SECTION*

Fig. 12



*Includes abundant coal seams (cumulative 330-400 ft), carbonaceous shale, siltstone, sandstone. The folds have double-plunging hinge lines and closures that range from 500 to 2,000 ft. Multiple stacked reservoirs are present.

The sixth detachment zone is between Triassic and post-Triassic strata. The post-Triassic section overlying this detachment probably contains the most exciting exploration play of the structured belt. It is a resource play of unprecedented size.

The entire post-Triassic section contains abundant coal seams, carbonaceous shale-siltstone-sandstone. It also contains many thousands of NW and N-trending double plunging anticlines. Multiple directional/slanted holes could be drilled from single drilling leases to target this section at varying depths.

It is estimated 5,000+ anticlines might be drill-targeted with multiple wells per drilling lease. Completion, including advanced fracturing techniques, holds the key to success. This section contains numerous different and complex combinations of compression, gravity sliding, and shear folds and faults. In places, this detachment zone marks structural reversal: Synclines below the zone change into anticlines above it.

Each of the estimated 5,000+ double-plunging hingeline anticlines contains 300-500 ft of cumulative coal beds and 1,000-1,500 ft of carbonaceous shale, sandstone, and siltstone. The coal beds alone have gross storage of 100-300 cu ft of natural gas/ton. Each structure measures about 2 miles long with 1,000-2,000 ft of stacked closures. Each structure might contain 100-300 bcf of original gas in place. This does not include gas stored in the other rock types. Each anticline might support multiple holes from one drilling lease (Fig. 12).

Total contained gas in these structures might be between 500 tcf and 1,500 tcf, a worthwhile resource play.

In general, the rock bodies between the six detachment zones contain numerous disharmonic folds, stacked thrusts with rollovers associated with compression/gravity sliding, in the western reaches of this belt. Going E, there are gentle anticlines and broad synclines and compression and shear-formed low-angle W-dipping thrusts in the W flanks of these anticlines that contain small moderately E-dipping backthrusts. In more competent sections, the shale cored anticlines are broken through and small thrusts are in evidence.

All six detachment zones are not present everywhere in the structured belt. In its northernmost British Columbia portion, the first and deepest detachment zone is present. Gravity sliding prevented the development of the other five zones. In its N Alberta portion, two zones are present. In southern Alberta, in the Coleman-Waterton-Pincher Creek region, only the deepest detachment zone is present. The other five did not develop due to massive E ploughing of the McConnell rock blade.

Origin of the oil sands belt

The collision between foreign landmass and Canadian Shield caused massive deformation in basement and overlying sedimentary section.

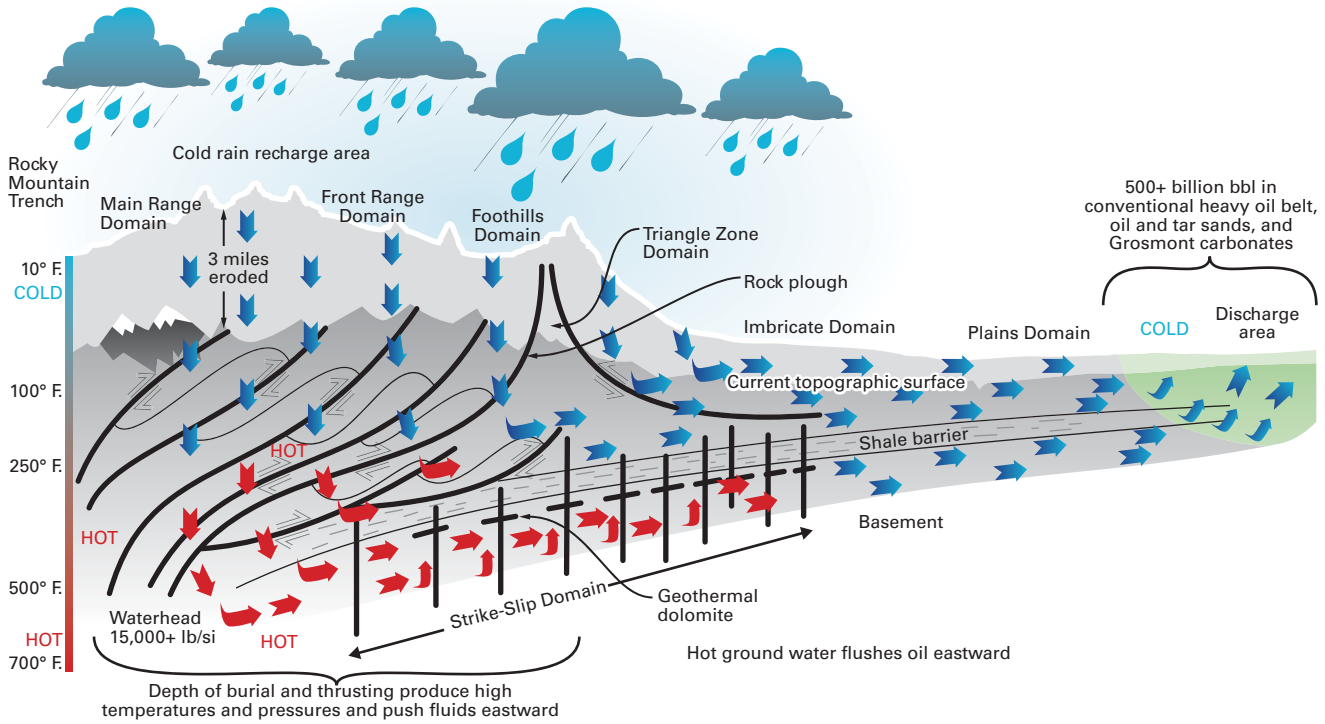
It produced a high topographic relief that attracted abundant meteoric water recharge and regional groundwater flows (down to 7 miles) with heads of 10,000+ psi. Water flowed 400 miles E to regional discharge regions close to the shield outcrop (Fig. 13).

The high pressure groundwater flow occurred simultaneously with E thrusting. The latter included high rock and pore fluid temperatures and pressures, mineral alterations, and crystal slurries. The combination flow and thrusting squeezed and laterally pushed heated and pressurized solution fluids/crystal slurries E ahead of the thrust front and into and through porous rock formations in the Strike-Slip and Plains domains.

When vertical conduits (strike-slip faults) were reached, the fluids vented upward and entered sheared and-or porous strata. In limestone, partial conversion to geothermal dolomite occurred,

DIAGRAMMATIC CROSS SECTION*

Fig. 13



*Shows thrusting from the west, the rock plough, the eastward pushed geothermal fluids and crystal slurries, entering strike-slip fault conduits, formation of geothermal dolomite beneath shale chemical barriers, and conventional heavy oil, tar sands, and Grosmont carbonates.

resulting in geothermal porosity and permeability enhancement of the rock. Further enhancement occurred where the carbonate section is overlain by shale (chemical barrier).

Thus, many dolomite reservoirs for oil and gas were formed capped by shale. The Slave Point represents this setting in NE BC. Others are the Triassic Pardonet/Baldonnel, the Permian Belloy/Belcourt, and the Debolt/Mount Head formations.

In sheared and-or porous sandstones, these solutions produced calcite cement, quartz overgrowth, silica cement, and possibly clay plugging, whereas in sheared shale silicification and calcification might have resulted. Invariably, bitumen is present in rocks affected by the intrusion of solution fluids/crystal slurries.

Water recharge heads and thrusting pushed the heated solution fluids/crystal slurries even farther E into formations not affected by deformation. The resultant flushing occurred along a broad front, 1,000 miles long and 400 miles wide, parallel to the mountains. Formation fluids, including water, oil, and gas, where pushed E thus creating regional fairways for hydrocarbon migration.

Higher temperatures allowed for more solution gas in oils, but gas was expelled from the oils on their way E while cooling off. There fluids including oil entered the younger, less compacted, porous rock sections over wide areas that presently contain 1) the conventional heavy oil belt, extending from N of Lloydminster to the US border, 2) the bitumen/tar sands extending from Fort McMurray to Peace River, and the 3) Grosmont carbonate bitumen belt farther N.

Most gas escaped, and oxygen-rich formation and meteoric waters oxidized the lighter ends, and heavier hydrocarbons remained. The enigmatic Turner Valley field structure (seismic transect ST 3, Part 3 of this article) is the only structure that both captured and retained large volumes of oil (1.3 billion bbl) in a Mississippian carbonate reservoir, possibly sourced from Cretaceous source rock from beneath the Turner Valley thrust.

Geochemistry evaluations of source rock, hydrocarbons, and coal maturation should be treated with great caution and in an unconventional manner because of this major hot fluid flushing of the sedimentary section and the eroded section in the WCSB.

Under normal overburden conditions, source rocks deliver certain volumes of hydrocarbons. The same source rock will deliver substantially more hydrocarbons when it is subjected to squeezing and torque (wrung out) from compression and simultaneous regional shearing.

Next week: The exploration/structural domains are distinctly different in structural style as illustrated in 15 seismic transects. ✦

Louisiana adds new reef sites for storm-damaged structures

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Baton Rouge

Widespread destruction during the 2005 hurricane season in the Gulf of Mexico has led to Louisiana creating additional Special Artificial Reef Site (SARS) locations for disposing of some offshore structures damaged during the storms.

The Louisiana Advisory Council approves the establishment of these sites. During 2006, the council approved 10 projects representing 35 platforms as SARS areas within the Louisiana Artificial Reef Program (LARP).

Because the number of destroyed structures submitted for SARS review may have peaked, the project reviews from the 2005 hurricane season should finish by yearend 2007.

2005 hurricanes

Hurricane Katrina destroyed 46 platforms and severely damaged 20 others, while Hurricane Rita destroyed

69 platforms and damaged 32 others (Table 1, Fig. 1). The storms also destroyed 8 drilling rigs and another 19 rigs sustained much damage.

The creation of the SARS program in 1991 within LARP has allowed companies to reef offshore infrastructure such as platforms, drilling rigs, and derrick barges destroyed by hurricanes or other unusual circumstances.

Louisiana created the SARS program initially to accommodate a drilling rig in South Timbalier Block 86 that collapsed during Hurricane Juan in 1985.

LARP has nine designated sites for disposition of offshore structures as artificial reefs (Fig. 2). Under normal conditions, a structure that falls outside these nine areas must either be towed to it or moved ashore.

For structures destroyed in hurricanes, SARS allows the LARP to establish reefs outside of the nine designated areas.

SARS approvals

State regulators must decide if a project submittal fits the SARS program based on:

- Would the destroyed structure benefit recreational or commercial fishing, or fish habitat at its current location?
- Would the site pose a threat to navigation or other users, or interfere with future oil and gas field development?
- Could the site serve as a biological field study or a location for future decommissioned structures?

Regulators evaluate the technical and environmental aspects of each project, and if the structure fails to offer benefits for the marine habitat, the structure owners will have to remove it in accordance with federal requirements.

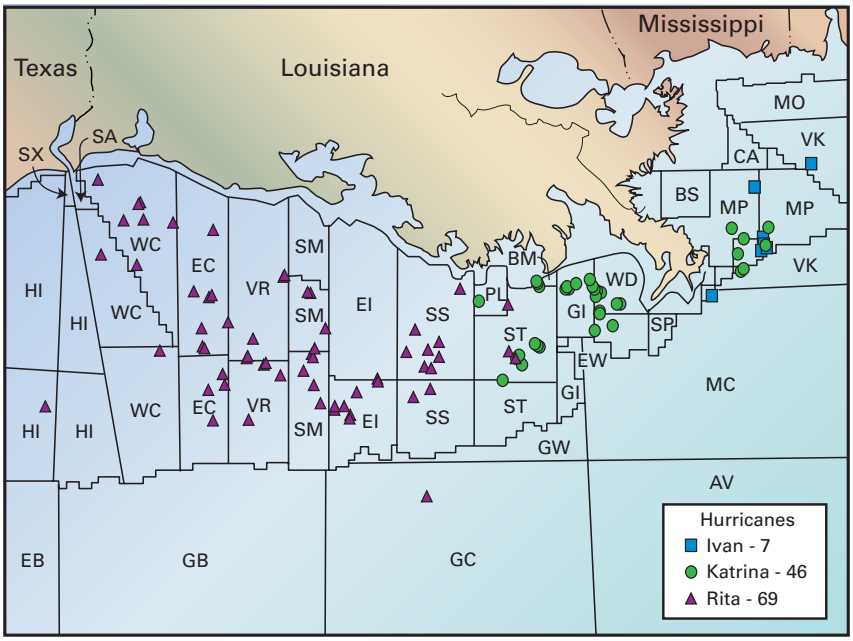
Decommissioning platforms

A platform destroyed in a hurricane usually lies horizontally on the seafloor, as if the structure was pushed over on its side. In some cases, much of the structure may have been submerged in mud. Structural integrity of jacket components likely is unknown, increasing the risks for lifting operations. Complete removal also may not be technically feasible or may pose risks to divers that exceed acceptable limits.

If the structural integrity meets

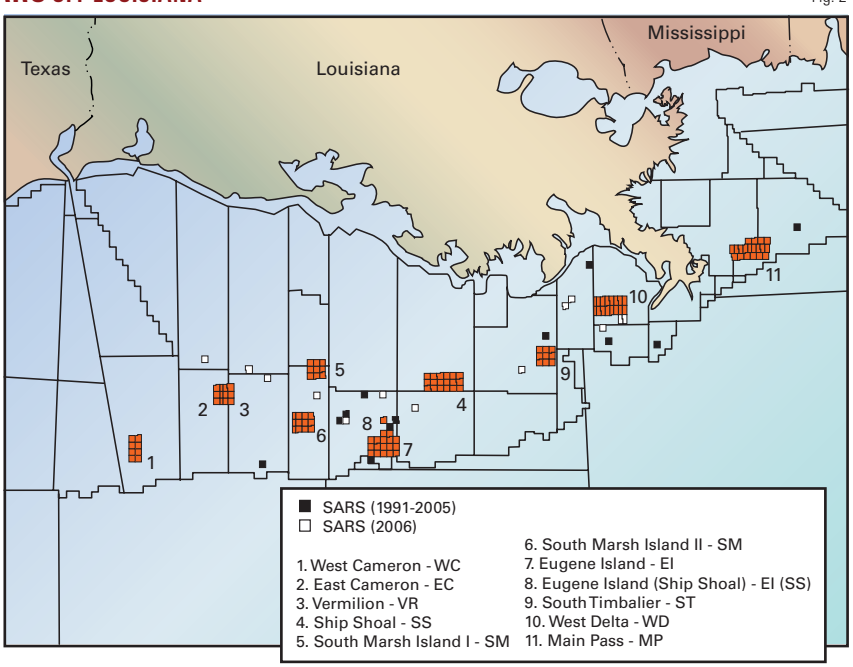
HURRICANE DESTROYED STRUCTURES

Fig. 1



SARS OFF LOUISIANA

Fig. 2



minimum thresholds, the platform then can be lifted and transported ashore or to a reef site; otherwise, the toppled structure requires cutting and removal in pieces or dismantling in a manner that satisfies clearance requirements.

Diving personnel or remotely operated vehicles (ROVs) have to cut and move debris to establish access to wells. Diver exposure may greatly exceed the time required in normal operations, increasing risks and costs. The divers also work in conditions with limited access and poor visibility.

Decommissioning tasks often are complex and require the design of new tools. ROVs can reduce the need for divers, but in most cases, ROVs cannot do all the operations required and are expensive to operate.

The cost for decommissioning a destroyed structure may be 5-25 times more than for an undamaged structure.

The petroleum industry has extensive experience in decommissioning offshore structures in the gulf, but only a small fraction of this work—about 5%—relates to removing structures damaged by weather.

The industry, to date, has removed 1,286 caissons and 1,438 jacket structures from the gulf (Fig. 3), and for the past decade removals have averaged 136 structures/year.

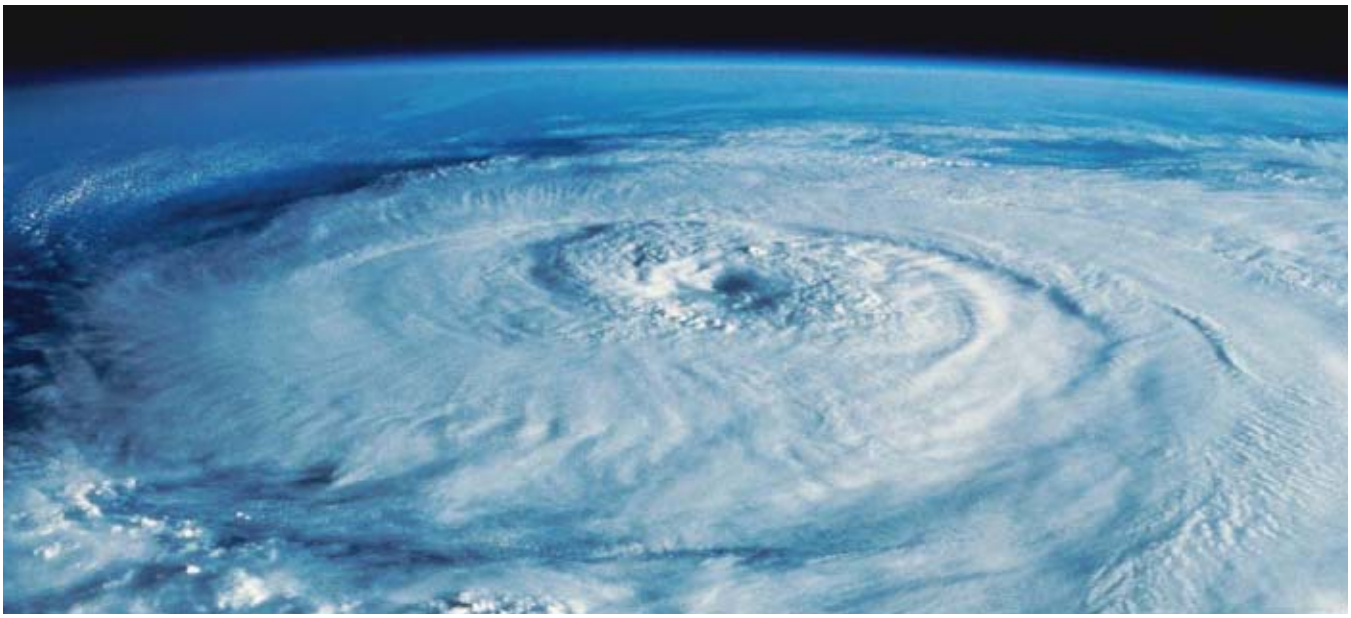
Rigs-to-reef program

In 1984, US Pres. Ronald Reagan signed the National Fishing Enhancement Act (NFEA – Title II of Public Law 98-623) to "promote and facilitate responsible and effective efforts to establish artificial reefs ... constructed or placed for the purpose of enhancing fishery resources and commercial and recreational opportunities."

The NFEA consolidated several decades of local and state laws and directed the National Marine Fisheries Service to develop the National Artificial Reef Plan to serve as a guide to state artificial reef programs. The NFEA also mandated the Secretary of Commerce and other support groups to develop a long-term plan for siting, constructing, permitting, installing, monitoring, managing, and maintaining artificial reefs within and seaward of state jurisdictions.

The US Minerals Management Service (MMS) adopted a rig-to-reef policy in 1985,[1-2] and in 1986, the Louisiana Fishing Enhancement Act (Act 100-1986) created the LARP.[3] In 1991, the Texas legislative established the Texas Artificial Reef Plan.

The industry has donated 147 structures for artificial reefs in LARP between 1987 and 2006 and 91 structures to the



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Production Optimization

Texas Artificial Reef program between 1991 and 2006.

Regulatory requirements

Various government bodies regulate offshore structure decommissioning and abandonment. The regulatory body with primary responsibility depends on the structure's location. State agencies are responsible for structures in state waters; the MMS is responsible for structures in federal waters.

Regulations in 30 CFR §250.1703 specify general requirements for decommissioning in federal waters and require, within 1 year after the lease or pipeline right-of-way terminates, permanent plugging and abandonment of all wells, removal of all platforms and other facilities, and clearance from the seafloor of all obstructions created by the operations.[4]

The same federal regulations that guide normal decommissioning operation apply to infrastructure destroyed by accident, terrorism, or natural catastrophe, but approval delays may occur, depending on the nature of the destruction and market conditions following the event.

Decommissioning decision

For a mature field with marginal production, an operator may not find it economically justifiable to repair or replace a damaged or destroyed platform. Several factors affect the decision to repair, replace, or abandon damaged and destroyed infrastructure.

For structures, the return on investment on fabricating and installing a new platform, subsea assembly, or pipeline interconnections depends on:

- Costs for removing and repairing the destroyed or damaged structure.
- Costs for plugging and abandoning wellbores.
- Costs for reentry and redrilling wells.
- Estimates of remaining reserves.
- Current and forecast commodity prices.
- Operating costs.
- Strategic considerations.

For pipelines, companies recover the return on investment primarily through flow rates, so that a critical factor in making a decommissioning decision is the expected depletion rates of the producing area.

P&A

An operator must permanently plug and abandon (P&A) all unplugged and temporarily abandoned wells on a lease within 1 year after the lease terminates. If MMS determines that the well poses a hazard to safety or the environment or if the well is not useful for lease operations and not capable of profitable oil or gas production, the well may need to be P&A'd before this time.

Economic and strategic considerations determine if wells on a destroyed structure should be temporarily or permanently P&A'd. A temporarily abandoned well will be re-entered in the future when the field is redeveloped. If the decision is to cease production at the structure and not redevelop the field, all wellbores must be permanently P&Aed. In either case, prior to P&A operations, the operator must clear the debris around the site to establish access to the wellheads.

Well P&A procedures and tools are designed for vertical access, but hurricane-damaged wells may not allow vertical entry. Without the structure, the

HURRICANE DAMAGE

Table 1

	Ivan	Katrina	Rita
Platforms destroyed	7	44	69
Platforms extensively damaged	20	20	32
Rigs adrift	5	6	13
Rigs destroyed	1	4	4
Rigs extensively damaged	4	9	10

Source: MMS

RPI definition

RPI is defined on a project basis as follows:

RPI = HV(A+B+C),

where HV represents the number of platforms in the project, and A, B, and C are weight factors based on the distance of the project to the nearest reef site (REEF), distance to shore (SHORE), and clearance at the site (CLEAR). Value of the weighing factors are:

$$A = \begin{cases} 1, & REEF \le 2 \\ 2, & 2 < REEF \le 10 \\ 3, & REEF > 10 \end{cases}$$

$$B = \begin{cases} 3, & SHORE \le 35 \\ 2, & 35 < SHORE \le 70 \\ 1, & SHORE > 70 \end{cases}$$

$$C = \begin{cases} 2, & 50 < CLEAR \le 85 \\ 3, & 85 < CLEAR \le 130 \\ 1, & CLEAR > 130 \end{cases}$$

Distance to the nearest reef site (REEF) and shore (SHORE) is in miles, while clearance (CLEAR) is from the top of the submerged structure to the water line in feet.

As distance to the nearest reef site in a designated planning area increases, it is more likely that towing the structure to a reef site would be uneconomic. The value of A gives priority to projects that are not close to a designated reef site.

The value of B is related to the distance to shore. A site that within 35 miles to shore is given priority because such a site would be the most likely to attract recreational fisherman, while as the shore distance exceeds 70 miles, the weight factor drops to unity.

The amount of relief at a site is an important factor in habitat value. The best habitat conditions for reefs are to maintain the greatest amount of relief within the clearance requirements of the Coast Guard.

The value of C reflects the preference for structures that have an 85-130 ft clearance.

work requires a jack-up rig or a liftboat, and the operation may have similar characteristics and costs to plugging a wet (subsea) well.

Well conductors usually bend at the mudline with the toppled structure, and in some cases, the toppling may sever the conductors. To gain vertical access to the wellbores, the operation may require that the conductors be first cut before plugs are pumped into the well.

These operations are more expensive and risky than cutting conductors in the usual manner.

Structure donations off Louisana

Table 2

Year	No. of platforms	Total donation, $	Average donation, $/structure
1987	1	250,000	250,000
1988	4	350,000	87,500
1990	4	875,000	218,750
1991	4	1,292,870	323,218
1992	10	1,326,876	132,688
1993	13	1,132,404	87,108
1994	17	1,266,442	74,497
1995	5	564,840	112,968
1996	4	736,280	184,070
1997	8	1,167,385	145,923
1998	4	327,641	81,911
1999	11	4,274,657	386,605
2000	12	1,757,244	146,437
2001	3	145,000	48,333
2002	9	1,244,136	138,237
2003	12	4,103,981	341,998
2004	14	3,384,689	241,764
2005	6	2,223,326	370,554
2006	6	2,820,102	470,017
Total	**147**	**29,242,874**	**198,931**

Louisiana Artificial Reef Program, 1987-2006

Removal options

Federal regulations require platform removal from a lease within 1 year after production on the lease ceases. This is also the time when all remaining wellbores are plugged, and production tubing strings and conductors are cut and pulled in accordance with federal regulations. Under normal conditions, the operator has three options for removing the platform: complete removal, partial removal, or topple in place (Fig. 4):

In a complete removal, a lift vessel removes the jacket structure in one piece or in sections, depending on the jacket size and the vessel lift capacity. The work involves cutting off the foundation piles 5 m (15 ft) below the seabed and transporting the piles and removed jacket ashore for recycling, storage, refurbishment, or disposal. Another option is to transport the jacket and dispose of it at an artificial reef site.

In a partial removal, the work entails cutting off the jacket at a depth specified by US Coast Guard (USCG) regulations such that an unobstructed water column exists for safe navigation above the remaining part of the jacket. Abrasive cutting or divers are used to sever the jacket because explosives are not permitted in open water.

The bottom part of the jacket remains attached to the seafloor, while the top part may be taken ashore for recycling, storage, refurbishment, or disposal. Another option is to place the top portion on the seabed next to the bottom section of the jacket. The operator must satisfy all regulatory requirements for the creation of an artificial reef at the site.

A structure that is toppled-in-place involves cutting the jacket legs so that the jacket collapses under its own weight, or by using a pull barge to provide the forward momentum. Regulations require an unobstructed water

SARS projects prior to 2006

Table 3

SARS area-block	Source area-block	Donor	Date	Water depth source site, ft	Water depth reef site, ft	Rational
ST-86	ST-86	ODECO	Sept. 20, 1991	91	91	Drilling rig, sunk during Hurricane Juan
WD-134	WD-134A	MMS	Sept. 12, 1965	280	280	Hurricane Betsy
WD-134	WD-134B	Kirby	Jan. 21, 1992	280	280	Addition
WD-134	WD-138	Shell	June 4, 1992	275	275	Addition
WD-134	WD-133	Elf	Apr. 17, 1993	280	280	Addition
WD-134	SP-54	Vastar	June 2, 1999	297	282	Addition
WD-134	SP-78	Texaco	Apr. 25, 2002	280	274	Addition
WD-134	WD-122C	Maritech	Aug. 12, 2004	227	280	Addition
GI-9	GI-9	Freeport	Jan. 14, 1999	52	52	Construction accident
GI-9	AOD	AOD	Jan. 31, 1999	51	51	Derrick barge sank during construction
MP-243	MP-243A	Coastal	June 22, 2000	196	196	Hurricane Georges
MP-243	MP-243B	Coastal	June 22, 2000	196	196	Addition
MP-243	MP-243A	Coastal	June 22, 2000	196	196	Addition
MP-243	MP-198A	El-Paso	Oct. 10, 2000	196	196	Addition
EI-313	Penrod60	None	June 19, 1972	—	236	Drilling rig
EI-313	EI-313A	Texaco	Aug. 3, 2000	236	236	Biological study
EI-313	EI-313A	Texaco	Aug. 3, 2000	236	236	Biological study
EI-313	EI-295	POGO	Sept. 30, 2002	211	236	Addition
EI-313	EI-335	Murphy	Sept. 8, 2004	272	236	Addition
EI-313	EI-231CB	Chevron	Sept. 9, 2004	219	236	Addition
EI-313	EI-315B	Newfield	Dec. 20, 2005	250	250	Addition
EI-309	EI-309	Forest	Sept. 18, 2003	225	225	Biological study/Hurricane Lili
EI-324	EI-324	Newfield	Sept. 23, 2003	265	256	Biological study/Hurricane Lili
EI-273	EI-273	Forest	Apr. 24, 2004	191	191	Biological study/Hurricane Lili
EI-322	EI-322AP	BP	June 22, 2004	255	255	Biological study/Hurricane Lili
EI-322	EI-322AD	BP	June 22, 2004	255	255	Biological study/Hurricane Lili
SP-89	SP-89	Marathon	July 1, 2004	393	393	Deepwater reef criteria
EI-384	EI-384	W&T	Apr. 28, 2005	431	431	Deepwater reef criteria
VE-395	VE-395	W&T	July 28, 2005	428	428	Deepwater reef criteria

column of a specific depth for a structure toppled-in-place and the structure must satisfy the regulatory requirements for the creation of an artificial reef at the site.

Site clearance

The last task in decommissioning is site clearance and verification. The operator has 60 days after removing the structure to clear the site and verify clearance.

For structures that are reefed in place, the regulators frequently waive site clearance and verification requirements. For structures destroyed in a hurricane, steel and other material debris may remain on the seabed in and around the site, depending on the nature of the removal operation and regulatory agency approval.

Destroyed structure removal

The risks involved in decommissioning destroyed infrastructure are higher than under normal conditions. Structures destroyed by storms cannot undergo the normal topsides inspection and preparation stage, such as flushing and cleaning piping and equipment, preparing modules and support frames, and flushing and cleaning pipelines.

A destroyed structure typically lies on the seabed similar to a structure toppled-in-place. In these cases, access to wells is more difficult, and the only thing holding back flow from the well is the subsurface safety valve.

If floating structures break free from their moorings, the structure may float away several miles from the field. For example, Hurricane Rita flipped the Typhoon tension-leg platform in Green Canyon-237 upside-down and moved it nearly 100 km from the field.

In June 2006, Typhoon was disposed of in a SARS in the Eugene Island area.

Liability

MMS regulations provide that a platform operator may be released from removal obligations if a state agency responsible for managing fisheries resources will accept liability. The Louisiana Fishing Enhancement Act established the Department of Wildlife and Fisheries as the responsible agency off Louisiana.

The state assumes ownership of the structure after a company donates it to the reef program and the state is responsible for any future costs of buoy construction and replacement, operation, and liability.

The Act absolves the donor and other participants constructing a reef from liability provided they meet the terms and conditions of the reef permit.

Donation requirements

Operators that donate a platform for an artificial reef can often lower the decommissioning cost below the cost of bringing the platform ashore for disposal, but many factors determine the cost of converting a platform into a reef, and subsequently, the cost savings, if any.[5]

Location is one of the primary factors. Structures close to shore that meet clearance requirements can be towed to the nearest port or scrap yard. Farther offshore, reefing is more economic when a structure is close to a designated reef planning area.

Different decommissioning options will generate various cost estimates based on the platform characteristics (size, weight, and complexity), site (water depth, distance to shore, and distance to nearest reef site), operator requirements (cutting method, scheduling, and contract structure), and conditions at the time of the operation (available equipment, market rates, and weather).

Cost savings from reefing can vary from less than 10% relative to the cheapest alternative to more than 100%, depending on the removal method, operator requirements, and assumptions involved in the estimate. In some cases, reefing may cost the operator more than removal to shore.

The state and operator obtain a third-party estimate of the cost for removal alternatives before the decommissioning operation. This estimate is

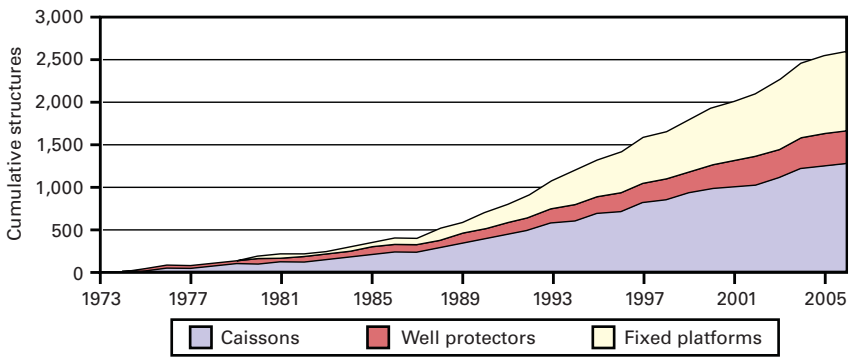
SARS APPROVED IN 2006

Table 4

Area-block	Water depth, ft	Donor	Approved	No. of platforms	RPI
WD-117C	214	AngloSwiss	June 2006	5	40
SS-269A	206	Maritech	June 2006	3	18
WD-103/104	223	Apache	June 2006	3	24
EC-222	124	ERT	June 2006	2	16
VE-255	158	Stone	June 2006	2	16
EI-276	176	Chevron	June 2006	3	18
VE-245	128	Chevron	June 2006	3	24
GI-40/48	90	BP	Nov. 2006	8	64
ST-161	117	Apache	Nov. 2006	3	24
SMI-108	183	Stone	Nov. 2006	3	18

GULF OF MEXICO REMOVED STRUCTURES

Fig. 3

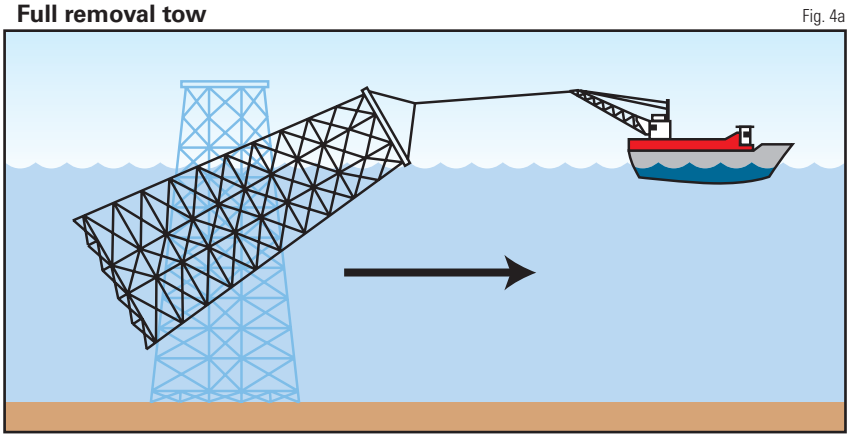


REEFING METHODS

Fig. 4

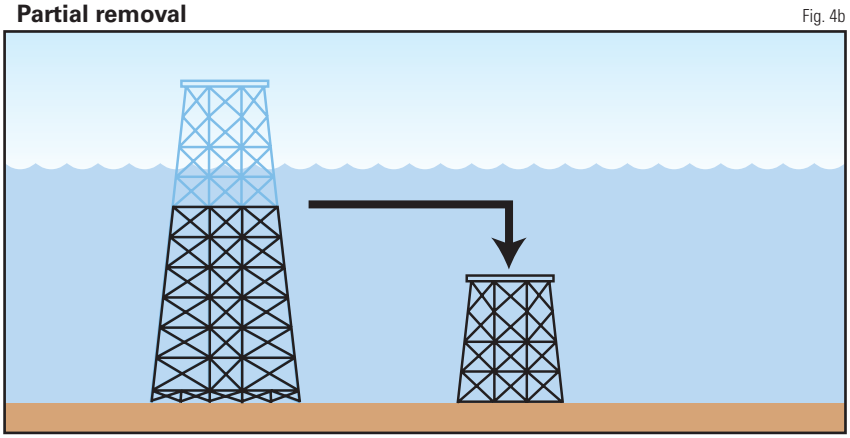
Full removal tow

Fig. 4a



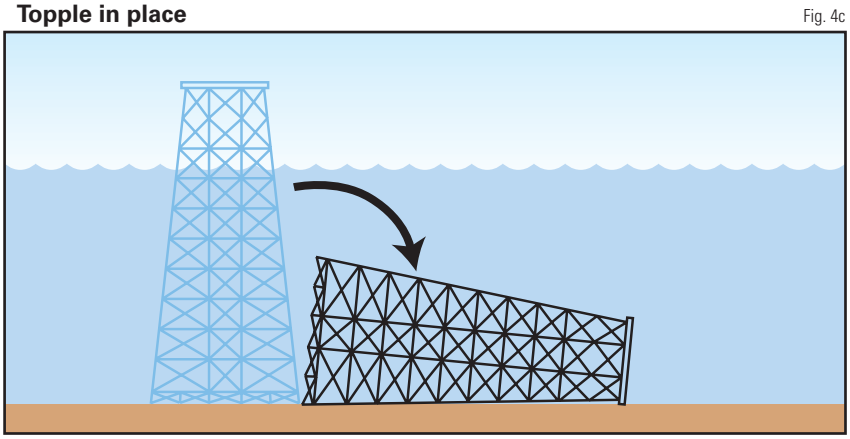
Partial removal

Fig. 4b



Topple in place

Fig. 4c



Source: MMS

the basis for determining the donation amount.

The operator and state split evenly the cost savings associated with a reef donation.

LARP statistics

Table 2 shows the structures donated to LARP, donation amounts, and average annual donation per structure. From 1987-2006, operators have donated 147 structures at 36 sites and the trust fund has accrued $29.2 million plus about $5 million in interest, totaling $34.2 million.

The number and amount of donations vary with time, and during the past decade, operators have donated about eight structures/year at an average donation of $1.54 million/year, or $200,000/structure.

Eight of the 147 platforms donated to LARP through 2006 were destroyed by hurricanes, and 29 of the 147 structures are in SARS.

SARS definition

A site, and materials contained at the site qualifies as a SARS when one or more of the following criteria are met:

- There is a historical or biological significance associated with the site; if, for example, a particular area is a successful fishing spot frequented by fishermen or divers or if the site provides good fishery habitat.
- The site is part of a cooperative effort between the LARP and another state, federal government, or private group.
- The site contains shipwrecks or other derelicts that cannot be practicably removed or relocated, and the site provides benefits to the LARP.
- The site forms an integral part of experimental or demonstration projects undertaken by the LARP.

The accompanying box shows the procedures for establishing a SARS.

A site considered for SARS must meet the following criteria specified in Amendment II of the Louisiana Reef Plan:[6]

- Benefit recreational or commercial fishing, or fish habitat.
- Help fish populations by not removing existing material from site.
- Not a threat to navigation;
- Not currently in bottom trawlable area.
- Overall benefit user groups.
- Eliminate from an existing planning area an area of equal in size to the SARS.
- Except for possible trace amounts, the structures are free and clear of any hydrocarbons or other hazardous ma-

terials as listed in current US Environmental Protection Agency regulations.

Screening criteria

A Reef Priority Index (RPI) defines the priority of projects submitted for SARS review (see accompanying box).

The RPI provides a screening tool for the projects that then are evaluated on a case-by-case basis. Items taken into account include value of habitat formed, available fishing reports, number of platforms, ability of the site for disposing of additional structures, distance to nearby planning areas and other SARS sites, clearance, relief, pipelines, and proximity to mud-slide prone regions.

Locations without active pipelines were SARS candidates. Locations required a review if an active pipeline was within or bordering a lease at a distance less than 1,000 ft for the SARS.

Mud-slide prone areas in general are not appropriate reef sites because platforms may move, break, or become submerged. Submerged or buried platforms have little or no habitat value.

Another important factor in approving a SARS was the potential for disposing of additional structures at the site.

SARS

Before Hurricanes Katrina and Rita, LARP had 12 approved SARS that held structures destroyed in hurricanes, damaged in construction accidents, in biological studies, and met deepwater reef criteria (Table 3). The 12 SARS held 29 structures, including two drilling barges and one drilling rig.

Each SARS can accommodate 7-10 platforms, as shown in the development of West Delta-134, Main Pass-243, and Eugene Island-313.

At EI-273, EI-309, EI-322, EI-324, EI-384, SP-89, and VE-395, only one or two structures are currently contained at each SARS, but the sites will likely attract additional structures in the future.

Following Hurricanes Katrina and Rita, the LARP advisory council reviewed the scope of the damage from the storms and discussed the expected effect on the program. The council made recommendations to approve, to approve with modification, to discuss for future planning purposes, and to reject.

Project modifications typically require platform additions or removals at the site, and the discussion for planning purposes normally centered on the site's suitability for future additions and deepwater sites for large platforms.

In June 2006, the council reviewed applicant data for 25 projects with 39 destroyed platforms. Of these, the council approved 7 projects with 21 platforms for SARS (Table 4, Fig. 2).

In November 2006, the council reviewed 13 projects with 25 platforms and 3 mobile offshore drilling units (MODUs). The projects were both new and previously reviewed-reconfigured projects. The council approved 3 projects with 14 platforms (Table 4, Fig. 2), and did not recommend any of the MODU projects.

At yearend 2006, the council had approved 10 projects with 35 platforms for SARS. The average RPI for the approved SARS projects was 24.7 while for the 27 rejected projects it was 6.5.

Notable projects

Two SARS projects are of particular interest. An eight-pile platform owned by Taylor in MC-20 failed in a mud-slide region and was nearly 75% submerged below the mud line. Estimates indicate that the dredging for access and lifting the structure would require removal of mud equal to the volume of the New Orleans Superdome. The council did not approve the structure for a SARS because the habitat value of the Taylor platform is considered minimal.

BP proposed a reef site for an eight-pile platform at GI-40/48, less than 3 miles from the Louisiana Offshore Operating Port (LOOP) anchorage area. Clearance restrictions will require lighted buoys at the site, and because of the proximity to LOOP, the BP project will require further evaluation and risk assessment prior to approval. ✦

SARS procedural guidelines

Establishing a SARS follows a well-defined set of procedures, as follows:

- The Louisiana Artificial Reef Coordinator will draft a proposal to establish a SARS for submission to the Artificial Reef Council. The proposal shall include location, clearance, bottom profile, condition of structure, list of potential hazardous material, and justification that the criteria outlined are met.
- Following acceptance of the proposal by the Louisiana Artificial Reef Council, the intent to create a SARS will be announced through a Louisiana Department of Wildlife and Fisheries news release.
- Thirty days following news releases, if no major objections are received, the Louisiana Artificial Reef Coordinator will apply for the necessary permits. In the event objections are received, a public hearing will be held to provide further information before a final determination by the Council.

If appropriate, a Deed of Donation will be agreed upon by the donor and recipients of the reef material.

The Secretary of the Department of Wildlife and Fisheries shall sign all necessary permits and the Deed of Donation.

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Custom-built rig uses reverse-circulation pipe to drill basalt

Nina M. Rach
Drilling Editor

EnCana Corp. had a new rig built for reverse-circulation airlift drilling to prevent lost-circulation through thick, fractured, vuggy basalts. Encana was faced with drilling Miocene basalt sections as thick as 11,000 ft, overlying prospective sedimentary sections in three wells in south-central Washington State's Columbia River basin. The wells are operated by Denver-based Encana Oil & Gas (USA) Inc. but are being financed 100% by Shell. Denver-based Delta Petroleum Corp. has a 3.75% working interest.

The new drilling rig was built by Boart Longyear's Lang Exploratory Division, in the company's Salt Lake City yard. Boart Longyear, a member of the National Drilling Association, is a subsidiary of Advent International.

Reverse circulation

In conventional rotary drilling, drilling fluids or gases are pumped down the drill pipe, out through the drillbit, and return to the surface carrying drill cuttings in the annulus between drill pipe and wellbore.

Reverse-circulation drilling uses a special "pipe-in-pipe" coaxial drillstring. Fluids are pumped down the annulus between the inner and outer walls of the drill pipe and return to surface through the inner pipe (Fig. 1).

Reverse-circulation (RC) drill pipe is dual wall; the inner pipe string is suspended within the outer pipe string. Joints are made up conventionally and the inner string is sealed when the outer barrels are threaded together. RC pipe can be used with rotary bits or air hammers.

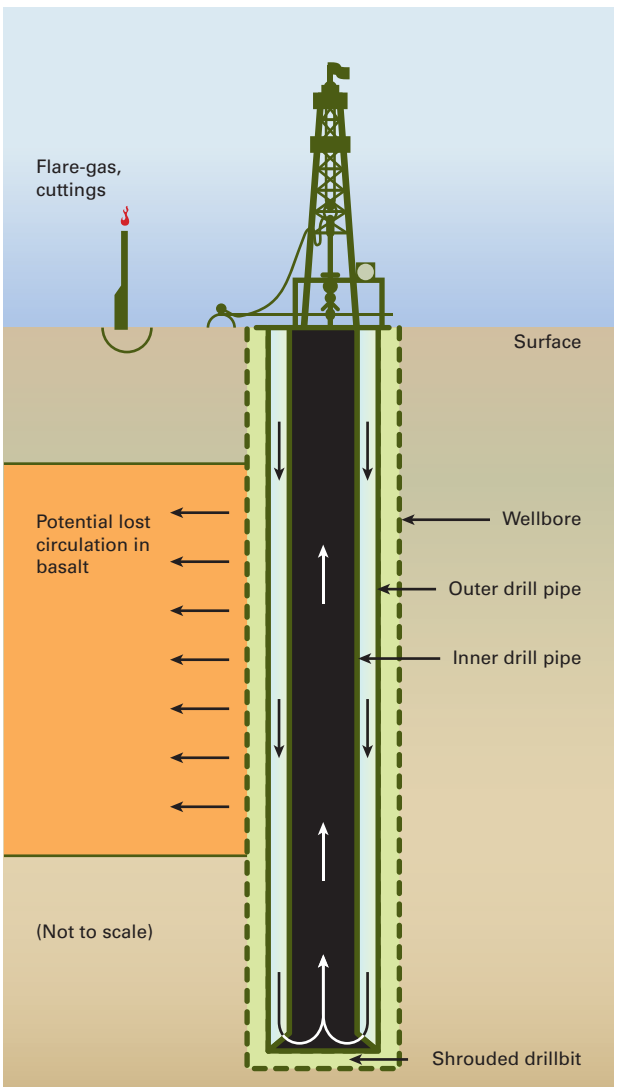
Compressed air is pumped after the drilling fluid, creating a dual-gradient fluid system. Perforations in the inner pipe allow the pressurized air to escape from the annulus and flow back up the inner pipe, creating a vacuum that helps to lift the cuttings.

Drilling fluids remain inside the RC drill pipe and cannot escape into the formations.

The drillstring used by Encana with the Lang rig is 6⅝-in. diameter external upset outer pipe with a 4-in. diameter

REVERSE-CIRCULATION DRILLING

Fig. 1



inner tube that is supported inside the outer pipe by a series of spiders.[1]

New rig

EnCana's Gary Houghton said that his company chose Lang for its experience working in basalts.[2]

The custom-built LM700 cost about $4 million and uses reverse-circulation airlift to get through the hard basalts interspersed with lost-circulation zones.

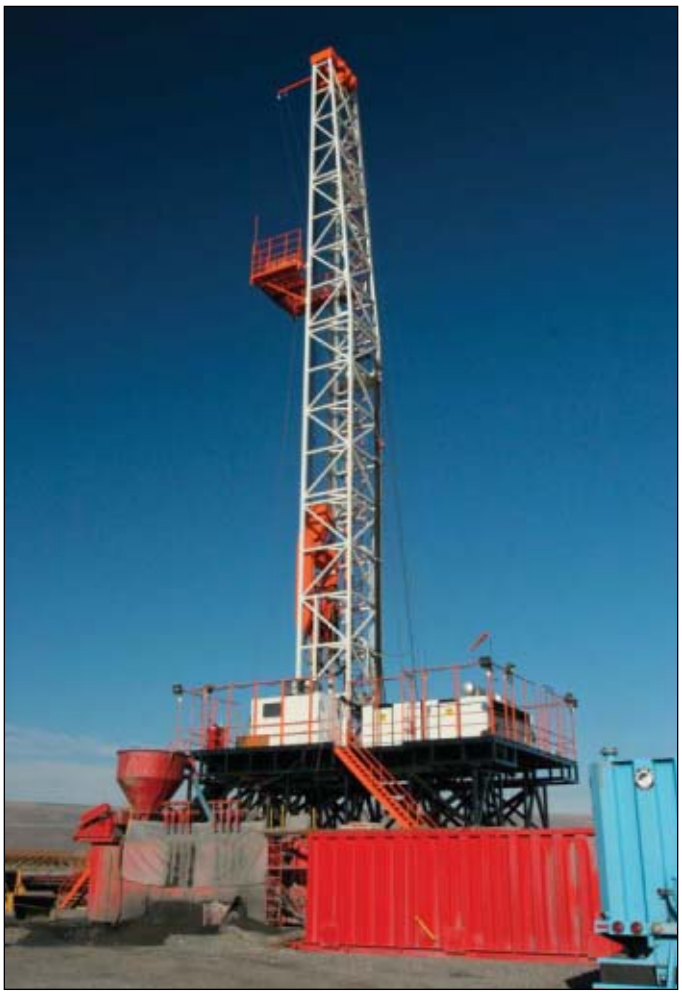
The derrick has a 700,000-lb hookload capacity, includes a top drive, and sits on a 23-ft high substructure. The mast can accommodate 100-ft stands of pipe and can hold as much as 12,000 ft of 6⅝-in. diameter dual-wall pipe or up to 16,000 ft of conventional pipe (Fig. 2).

The drilling system includes a 30,000-gal fluid system, two 900-cfm compressors, 1,400-psi booster, and a 65-ton Link Belt crane.[1]

On the first hole, the Lang rig drilled about 120 ft/day, more than double the previous rate of 52 ft/day.[1]

Three wells

EnCana has the largest acreage position in the Columbia River basin, about 811,000 net acres. It used the LM700 rig to drill the basalt sections in three 14,000-ft wells in Grant and Yakima counties, Wash.:



Lang Exploratory Drilling built the LM700 triple rig for EnCana's Washington state drilling (Fig. 2; photo from EnCana Corp.).

- EnCana Anderville Farms Inc. 1-6, in the Saddle Mountains, about 7 miles east of Mattawa.
- EnCana Anderson 11-5, about 8 miles north of Sunnyside (Fig. 3).
- EnCana Brown 7-24.

The drilling plans involved using the Lang rig for RC drilling through the basalt sections, followed by a conventional rotary rig (DHS Drilling Co. Rig 7) for the underlying sedimentary sections (Fig. 4). Bill Delahoussaye is the on site drilling supervisor for EnCana Oil & Gas Inc.

The first well, Anderville Farms 1-6, was initially spudded in December 2004 with a truck-mounted Lang rig using a reverse-circulation system but was not able to complete the drilling, which prompted construction of the new LM700 rig.

The LM700 rig reentered the hole in September 2005 and drilled to 7,800 ft. The sedimentary section was drilled by a second rig to about 14,500 ft, com-

The LM700 was disassembled at the EnCana Anderson 11-5 wellsite in November 2006, before being moved to the third wellsite (Fig. 3).

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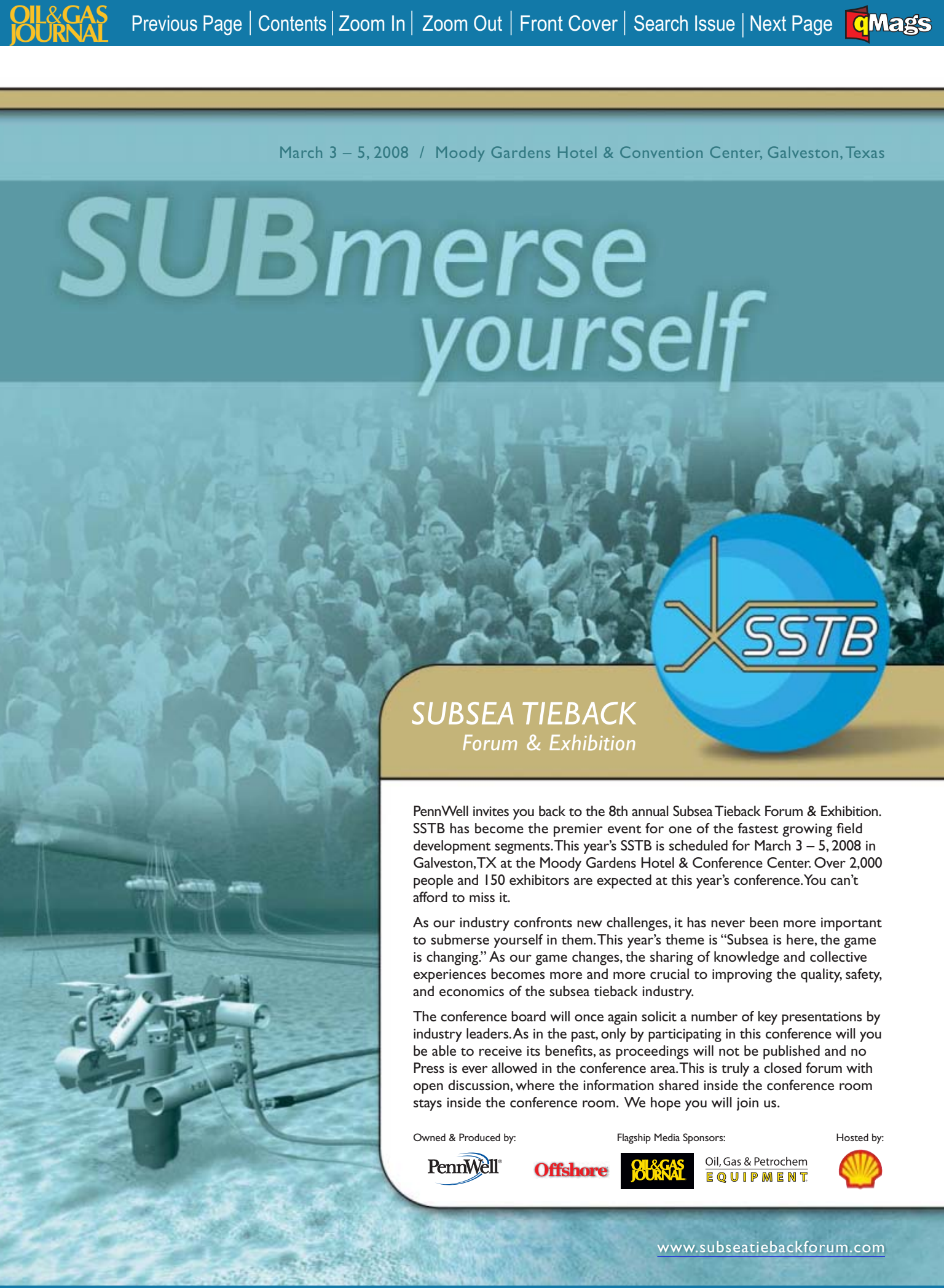

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pleted in August 2006.

EnCana spudded the second well, Anderson 11-5[1] in hilly terrain August 2006, and the Lang rig was to drill to about 11,000 ft. By early November 2006, the basalt section in the Anderson 11-5 was completed and DHS Rig 7 was in place, to drill to about 14,000 ft. The Lang rig was disassembled (Fig. 3), ready for transport to the third and northernmost wellsite, Brown 7-24.

In its first-quarter operating results, announced May 7, Delta Petroleum said the Brown 7-24 well was "drilling and should reach total depth in early summer."

EnCana spokesman Alan Boras confirmed drilling status to OGJ and said, "Generally, the Lang rig has worked very well, with no real trouble time, such as getting stuck in the hole. Overall, the drilling pace has been slower than expected due to the challenging nature of the geology. We are happy with the performance of the technology for drilling through the basalt."

DHS Drilling Co.'s Rig 7 was mobilized from Wyoming to drill the sedimentary sections underlying the basalts in the second and third EnCana wells (Fig. 4; photo by Nina M. Rach).

Additional drilling

Delta Petroleum holds about 468,000 net acres in the Columbia River basin and is permitting three wells of its own, south of the Encana wells and near the Oregon border. Delta will spud its first operated well, "Alpha," in third-quarter 2007 with drilling contractor DHS Drilling.

Delta expects to drill the Alpha well to 14,000 ft, including 8,000 ft of basalt. Delta said that DHS Drilling believes it can drill 200 ft/day in basalt and 400 ft/day in sedimentary sections. Additional wells planed by Delta include "Beta," McBride 28-13, and Gray 31-23.

ConocoPhillips is the third-largest acreage holder, with about 400,000 net acres, but has not yet announced plans to drill.

Denver's Exxel Energy Corp. holds about 340,000 net acres in the basin (98% working interest). In an April 25 presentation at the OGIS conference in New York, Exxel described it as an "emerging basin-centered gas accumulation," with "world-class" untested anticlines and an existing pipeline infrastructure. The company has identified several prospects and will continue to evaluate its acreage.

RC drilling elsewhere

Calgary's K2 Energy Corp. used reverse-circulation techniques to drill four wells in the Cretaceous Bow Island formation in northwestern Montana (OGJ, Mar. 11, 2002, p. 42). K2 had a hard rock mining rig from Midnight Sun Drilling, Whitehorse, Yukon, for the shallow, low-pressure gas drilling. Midnight Sun used air hammers and dual-wall drill pipe with a 2⅞-in. inner string inside a 4½-in. outer string. K2 said using the reverse-circulation technique nearly eliminated formation damage and yielded commercial gas flows exceeding the results from rotary-drilled wells.

RC pipe

Calgary's Foremost Industries LP manufactures four types of dual-tube, RC pipe, and accessories (www.foremost.ca).

A 10-ft length of 6⅝-in. OD pipe typically weighs 480 lb (218 kg). A triple stand of dual-tube, RC pipe weighs about 4,800 lb. ✦

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Heat-stable salts reduce H_2S leaking from amine absorbers

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Yahya Feyzi
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An amine heat stable salt (HSS) is the thermally unregenerable protonated form of the amine. The HSS is itself a product of the neutralization reaction between the alkaline amine and an organic or inorganic acid. Such acids enter the solution either as the result of degradation of the amine or by absorption of sulfur oxides or other acid-forming components from the raw gas.

The presence of amine HSSs can cause poor sour-gas contactor and treating plant performance. The existence of HSSs is not, however, always detrimental to amine unit performance. Under certain circumstances, HSSs can actually help achieve reductions in H_2S leaking from absorbers.

This article recounts our experiences with solution switching from diethanolamine (DEA) to methyldiethanolamine (MDEA) and the effects of HSSs generation on our system performance.

System performance

Shahid Hashemi Nejad (Khangiran) Gas Co. lies in northeast Iran, 40 km from the Turkmenistan border. The sour-gas sweetening facilities based on amine are designed to treat natural gas with about 10% acid gas from Mozdouran gas field (Fig. 1).

Each of three trains (Gas Treatment Units 1, 2, and 3) was designed to treat 346,000 normal cu m/hr (300 MMscfd) sour gas with 910 cu m/hr DEA and constructed about 30 years ago.

Two trains, GTU Nos. 4 and 5, were added 5 years ago and are identical with previous trains. All were operating with DEA as solvent. A year ago after experimental stages, all trains were switched from DEA to MDEA.

The Khangiran gas plant, which is 40 km from the Turkmenistan border, processes 10% sour gas from Mozdouran gas field.

Operating on MDEA allows Khangiran to process 420,000 std. cu m/hr of sour gas with 890 cu m/hr MDEA. Analytical data were measured by Sulfur Experts Inc., Calgary, at the Khangiran plant.

The amine facilities at Khangiran are designed to treat natural gas by DEA as the amine solvent. About 3 years ago, one unit was switched from DEA to MDEA and, following an analysis of the results, other units were also switched. The performance of the units using MDEA has been better than those using DEA. (Some parameters include corrosion, energy consumption, amine circulation rate, and selectivity.)

But at every unit, the initial performance of fresh MDEA at absorbing H_2S in the contactors was less than desirable. Over time, however, the performance of absorber (H_2S removal from the natural gas) and regenerator (acid-gas loadings in lean amine) improved and stabilized.

Figs. 2 and 3 show acid-gas loading, H_2S content of lean MDEA, and the amount of H_2S in treated gas during 1 year of operation. Comparing two unit operations at the same conditions shows that the unit performance can improve over time. One unit with fresh (Unit No. 4) and another with 1-year-old MDEA (Unit No. 5) were kept in similar circumstances for 1 week. Feed (sour gas), amine-circulation ratio, lean-amine temperature to absorbers and reboiler steam consumption were roughly equal.

Fig. 4 shows the consequences of this experiment. The 1-year-old MDEA in Unit No. 5 has been more effective than fresh MDEA in Unit No. 4. The amount of HSS was 1.11% in Unit 5 and 0.39% in Unit No. 4 solvent.

These data were measured by an on site laboratory. Amine Experts, Calgary, also tests our amine solutions and confirmed that HSSs increase over time.

Improving H_2S removal

Consider a tertiary amine as an example.

When ionization of H_2S in water is combined with proton acceptance by the amine, the net overall reaction is: $H_2S + RN \leftrightarrows RNH^+ + HS^-$. The equilibrium constant for the reaction is $K = (RNH^+)\ (HS^-)/(RN)\ (H_2S)$.

It can be seen that if the concentration of the protonated form of the amine is increased, the concentration of HS^- will decrease in proportion, i.e., in the regenerator, the H_2S loading will drop.

This has the greatest potential impact at very low loadings because here is where the protonated amine concentration normally would be quite small (e.g., 0.001 mole/mole) but has been artificially made quite large. Consequently, there is a dramatically decreased equilibrium concentration of HS^- in solution and, therefore, a dramatic decrease in solution loading with respect to H_2S.

The reaction equilibrium has been shifted towards much lower H_2S loadings. This can lead to a regenerated

Gas Chromatographic Analyses
(Mole Percent)

NIGC
Khangiran, Iran

Feb 09, 2004
Job Number: E408

Sample No:	21	42	51	57
Site:	Feed Gas to GTU	NIGC Span Gas	Fuel Gas	NIGC Sales Gas
Time:	10:32	09:36	13:39	16:41
H2:	0.000	0.000	0.000	0.000
Ar:	0.000	0.000	0.000	0.000
O2:	0.0	0.0	0.0	0.0
N2:	0.368	1.430	0.408	0.425
CH4:	88.901	95.093	98.782	98.798
CO:	0.000	0.000	0.000	0.000
CO2:	6.459	0.677	0.000	0.000
C2H4:	0.000	0.000	0.000	0.000
C2H6:	0.509	1.464	0.563	0.564
H2S:	3.588	0.000	0.000	0.000
COS:	0.000	0.000	0.000	0.000
C3H8:	0.058	0.440	0.075	0.068
SO2:	0.000	0.000	0.000	0.000
CS2:	0.000	0.000	0.000	0.000
iC4H10:	0.008	0.158	0.015	0.010
C4H10:	0.028	0.222	0.037	0.033
iC5H12:	0.010	0.211	0.015	0.011
C5H12:	0.014	0.145	0.021	0.015
C6H14+:	0.035	0.161	0.065	0.048
Benzene:	0.015	**	0.014	0.015
E-Benzene:	0.002	**	0.000	0.002
Toluene:	0.005	**	0.005	0.004
Xylenes:	0.000	**	0.000	0.006
	100.000	100.000	100.000	100.000
H2S/SO2:	---	---	---	---
C/S Ratio:	27.079	---	---	---

Zero means not detected
Sampled water and sulphur free

Trace means less than 0.0005
** = Not Analysed

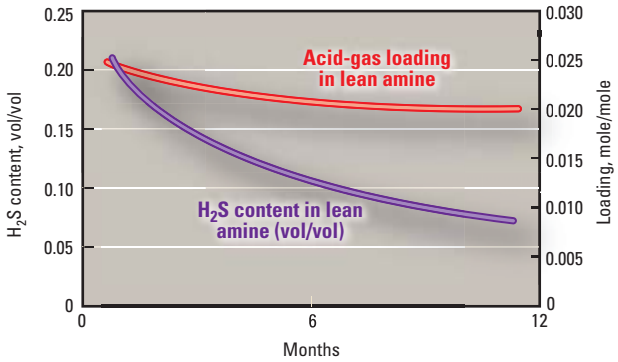
Sulphur Experts Inc. Calgary, Alberta, Canada

USA: +1 903-894-6029 Sulphur Experts Inc. Canada: +1 403-215-8400 The Netherlands: +31 72 571 7264
Page 40

Feed gas composition for the Shahid Hasheminejad (Khangiran) Co. reflects sour-gas conditions (Fig. 1).

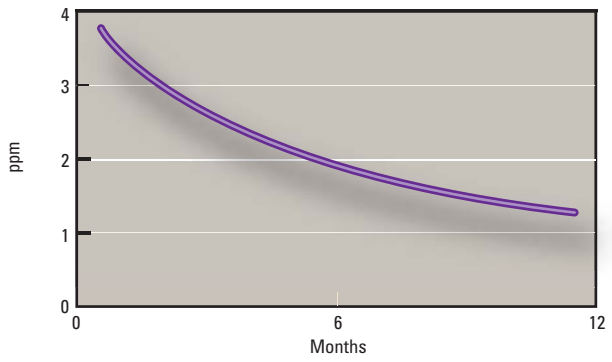
PLANT OPERATION

Fig. 2



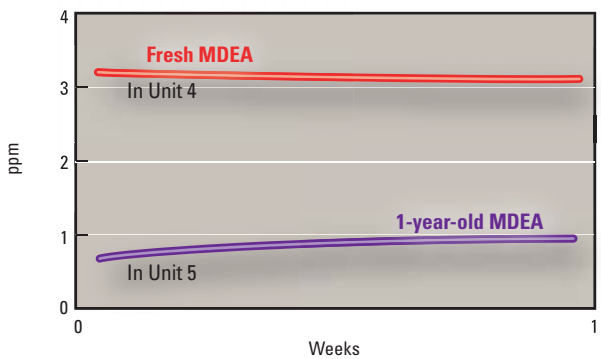
H_2S TREATED GAS IN OPERATION

Fig. 3



H_2S CONTENT IN TREATED GAS IN TWO UNITS

Fig. 4



solvent with more than an order-of-magnitude lower H_2S loading and, therefore, with the ability to remove H_2S to much lower levels.

The effect is very pronounced at the lean end of the regenerator (especially the reboiler) where the protonated amine and HS^- concentrations are already fairly small. Here, artificially enhancing the protonated amine concentration from a very small value to a relatively very large one results in a very large decrease in H_2S loading of the lean solvent.

It is remarkable that there is a similar reduction in residual CO_2 loadings because protonated amine is also a component in CO_2 reaction equilibrium. Although tertiary amines do not react directly with CO_2, they act as proton acceptors and can therefore take part in CO_2 reaction equilibrium $CO_2 + RN + H_2O \leftrightarrows RNH^+ + HCO_3^-$.

The reaction equilibrium constant is $K = (RNH^+)\ (HCO_3^-)/(RN)\ (CO_2)\ (H_2O)$.

Independently increasing the protonated amine concentration, especially at low loadings where the concentration of this species is normally quite small, will require a substantial decrease in the already-small HCO_3^- ion concentration to balance it. ✦

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2. "Shahid Hashemi Nejad Gas, Foaming Problems," Amine Experts Inc., Amine System Review, Oct. 25, 2005.

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[1] *Signet Readership Survey (February 2007)*

Improved database management yields pipeline integrity benefits

Nick Park
Christopher Sanders
GeoFields Inc.
Atlanta

Current industry trends in software design and careful examination of work patterns at pipeline operators have led to the development of new data management and analysis tools. These tools more effectively segregate the tasks of data management and data use, improving the speed, accuracy, and reliability with which pipeline operators can implement integrity management programs.

This article reviews a series of steps taken in pipeline data management to support both day-to-day and strategic integrity-management activities and provides examples of how new tools allow users throughout an organization to share, collaborate in the creation of, and analyze pipeline data stores.

A case study shows how streamlining data management allows operators to focus more of their energy on integrity management.

The problem

At the heart of a pipeline integrity management plan lies the need to bring together information from throughout the organization, see how various information pieces relate to each other, and act, based on patterns that emerge. This requires a thorough understanding of how the available data affect integrity, which in turn requires data to be integrated and aligned.

The often disparate nature of data and the various ways of gathering and reporting it can make aligning and integrating data difficult (Fig. 1a). A field report of a leak might give its location using GPS coordinates, while an in-line inspection may provide the location of pipe wall corrosion using an odometer reading. Landowner records may be sorted in sequence down the pipeline length, noting the tract length per parcel, while the latest close-interval survey of cathodic potential may record the number of readings at 2.5-ft spacings from the start of the survey. A series of points in a particular map projection may also provide location of the pipeline, with the as-built stationing recorded at each pipe bend.

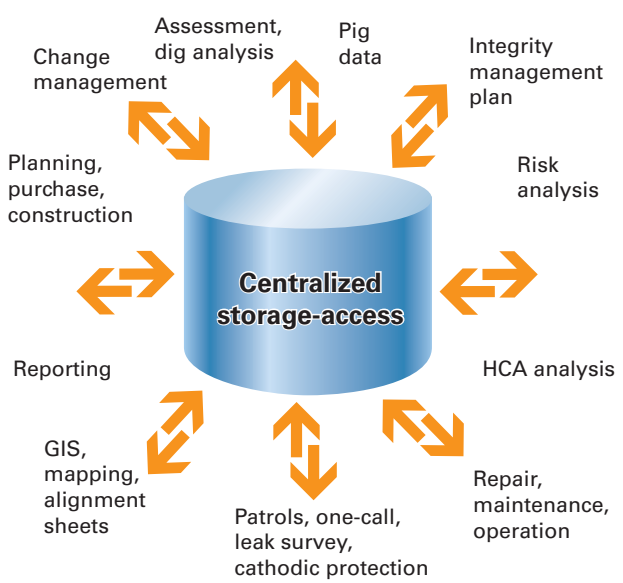
Different data also are often located in different parts of an organization. The

PIPELINE DATA

Fig. 1

Scattered Fig. 1a

Organized Fig. 1b



in-line inspection resides in an Excel spreadsheet on the corrosion engineer's personal computer, the close-interval survey is in a series of text files on a compact from the surveyor, the leak survey is in a handwritten paper report that's been scanned into a PDF file, and landowner records are in a small document management system built for the purpose several years earlier.

The operator needs to bring these data together in order to yield the proper integrity management conclusions (Fig. 1b). This involves, first, defining a place where data can be stored so that people know where to go for it and know how it is formatted, and second, establishing a common frame of reference to allow the location on the pipe of any information to be compared across the different data sets.

Data location

Methods available for data storage start with popular database software packages; Microsoft's SQL Server and Oracle's relational database platform being two of the most common. These provide the shell into which data can be loaded.

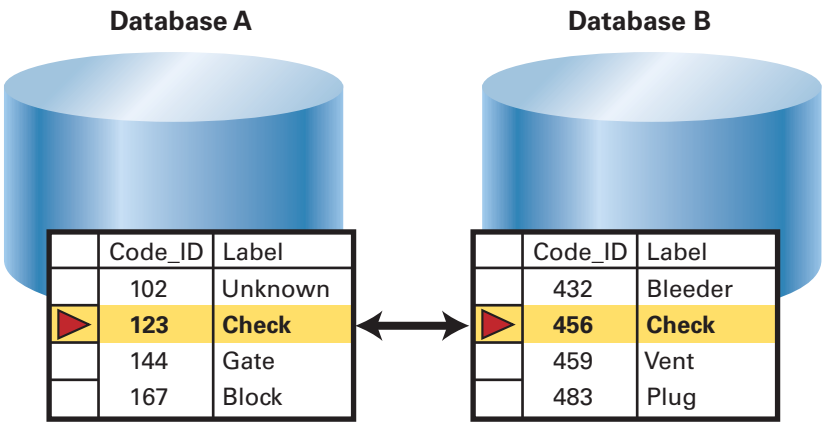
But for a database to be useful, the data need to be described, or formatted. Partnerships within the pipeline industry have developed several such formats. The Pipeline Open Data Standard is one of the most mature formats and describes a storage scheme for a wide range of pipeline data. Other data format standards tie into more specialized database systems such as those that focus on storing spatial data; e.g., ESRI Inc.'s ArcGIS Pipeline Data Model.

Many operators have also chosen to develop their own data formats, focusing on system performance or their own unique needs rather than on data interoperability, or the ability to share data between systems. The need rigorously to follow a standard format is decreasing as software becomes more flexible in reading different formats.

A data storage format, however, only addresses part of the storage problem. In addition to knowing the format in which data are stored, it is important to know how the format has been used. A database, for example might provide data about valves in a table, assigning each type of valve a number and storing it in a particular column. But a check valve might appear in one operator's database as type "123" and in another operator's as "456" (Fig. 2).

FLEXIBLE DATA MAPPING

Fig. 2



Data integration

The second part of the solution is aligning or integrating the data systematically. A geographic information system can accomplish this across disparate reference systems. A GIS combines a specialized database and analysis software. It is particularly beneficial for pipeliners wishing to integrate linear surveys and pipeline component data with the map data they may also have, a technique called "linear referencing."

This technique allows the GIS to merge two common reference systems: the spatial world (GPS coordinates, latitude-longitude, and data in map projections) and the stationing or milepost world. Bringing datasets into one of these two reference systems will allow the GIS to complete the final step of bringing them all together.

GPS coordinates associated with a leak report and pipeline location in map projection coordinates are all spatial data. The GIS handles these easily and can integrate them on screen by displaying a map. Modern GIS applications can merge data in different map projections and rapidly display very large datasets through smart database techniques.

The linear distance down the pipeline, often called stationing, chainage, mileposts, stake numbers, or kilometer posts, is essentially a measurement system established when the pipeline was built and sometimes updated as changes to pipe configuration occurred. An in-line inspection odometer directly corresponds to the measurement system, and tools now exist that allow the in-line inspection odometer to be converted to the stationing system by aligning common features in the survey and the pipeline database.

The same concept applies to close-interval surveys, in which the distance walked can be converted to stationing. Any dataset that uses distance along a pipeline can be integrated by the measurement system into the GIS.

The final step brings data in the two frames of reference—spatial and stationing—together. GIS stores the spatial pipeline data and the stationing system, and the GIS can display data stored using stationing at a spatial location, bringing the stationed data onto the same map as the spatial data and integrating it.

A series of analysis tools looks for patterns and can, for example, establish that a leak location is coincident with corrosion predicted in the in-line inspection run, as well as a dip in readings during the close-interval survey.

Mapping the extent of each landowner agreement using the tract length can determine landownership.

Seeking patterns

Data evolve over time. After a number of years, the in-line inspection and close-interval survey cease to be current descriptions of the pipeline and need to be rerun. The pipeline location may change as the result of reroutes, and performing more accurate surveys may refine its location or that of its component features.

Comprehensive data management software packages exist that can combine the storage of a database with the integration capabilities of GIS and tools specific to the pipeline industry. A database alone is not enough. Users need tools to comprehensively manage the pipeline data.

But most GIS packages don't have all the tools a pipeline operator needs to manage its data. An application that builds on database and GIS capabilities to provide workflows, such as survey data integration and pipeline configuration changes, is necessary. In partnership with the industry, a number of software companies have developed such applications, making the task of data maintenance smooth and reliable.

Comprehensively managing pipeline data is critical to the success of an integrity-management plan, ensuring users of reliable, current, and accurate data for their analyses without having to spend weeks hunting it down, and without being unsure of the format or quality.

Flexibility

Databases are not intuitive when used out-of-the-box and almost always require an additional software application. Users, accustomed to having data on their personal computers and within their control, also often feel a sense of detachment and a loss of control when data are centralized.

As systems become more flexible, however, they are moving away from applications bound so tightly to databases that the slightest change can render them inoperable. Instead, applications are becoming much more configurable to a range of different data formats. This is happening as software design heads in the direction of data format plug-ins and flexibility at its deepest levels and data modeling moves from strict standards to format guidelines and best practices.

A flexible application, instead of hard-coding itself to a particular table in a database, allows the user to pick the table and tell the application how data are stored. The pipeline company can then configure the database to suit all its needs, not just those of one application.

Applications have core needs, required to do their jobs. A mapping application needs some description of the pipeline location, for example. But storage of the underlying data should suit all the needs of the organization, not just one application. Inflexible applications require data to be duplicated, creating concerns about keeping different versions of data current and potentially making operational decisions based on outdated information.

Data control, key steps

- Bring survey data into a single, consistent database format where it can be aligned to the pipeline system.
- Automate data preprocessing for any type of analysis.
- Put responsibility for data quality with database managers, not users.
- Make sure reports connect summary results back to the original data.
- Use risk-analysis applications configurable to a range of data formats, avoiding data preprocessing and reformatting.

Database

Users should not have to know or care about the databases behind the tools they use. The database should remain the domain of a select few, those who design and maintain them. Users manipulating in-line inspection data or planning a dig should not need to worry about the format of data or where it resides. They should, rather, simply be confident that data will be available when they need it, in the format they request, and that it will be protected from inappropriate changes.

Achieving this level of simplicity in the pipeline world requires application design that enables users to be task-focused and keep data behind the scenes.

Case study

A major North American natural gas transmission pipeline operator found itself with data-management problems when preparing for its annual pipeline risk assessments. Its 7,000-mile system generated a considerable amount of pipeline asset data, in addition to that created by surveys and analyses performed to maintain its integrity.

The operator's annual assessment considers a variety of risk factors, including consequences of failure and threats that can influence the likelihood of failure. This process uses algorithms that weigh a range of different data sets against each other.

The problem for this specific company was not the algorithm; it was well developed and proven on small test datasets to yield an accurate relative risk score for any specific pipeline segment. The problem was processing 7,000 miles of pipeline data to suit the algorithm and get output useful to prioritizing maintenance and mitigation activities.

Data were spread over the entire company in a large number of formats. In some cases, data were being typed into a set of database screens for each of the 19,000 pipeline segments identified

for analysis. The risk-assessment team had become experts in data manipulation and had constructed a complex web of preprocessing steps to get data into the proper format. This process took many months and required extensive documentation if each of the final datasets were to be related back to its source, a critical step in justifying the results of analysis.

A typical annual risk analysis therefore involved data processing by up to four team members lasting 9 months. Data loading took a database analyst several additional weeks and included even more manipulation of data to suit the algorithms.

The company began a data-integration initiative to bring together the asset and survey data sets being collected routinely across the pipeline system into a central data management system. The goals of the initiative were to:

- Make a permanent home for all data sets so users could find data that they needed.
- Standardize the data formats so that users always knew how to access the data.
- Manage updates to the data so that users could be assured they were working with the most up-to-date information.
- Properly handle changes to the data so that dependencies between different datasets were properly accounted for in the event of an edit or update.

These were company-wide goals, but without a configurable risk analysis application the benefits for the risk team would not reach their full potential.

The company used the data-integration initiative to revisit the risk analysis software and found that a configurable risk-analysis application was available and would lead to dramatic improvements.

The company's first step was data integration, bringing disparate data from across the organization into a common aligned database. The balance of this article will focus on one of these data sets: in-line inspection data.

The operator used five separate survey vendors during the 5 years before the analysis, resulting in not only five different vendor formats, but also significant evolution in the data formats as inspection tool technology advanced. The inability of some vendors consistently to deliver in the agreed format also complicated the data.

The company wanted to load and align 56 individual in-line inspections into the corporate database. This process used template files to describe the different data formats by vendor and then vintage. Reusing these files to load the data significantly streamlined the process and brought the survey data into a single, consistent database format from which it could be aligned with the pipeline system, supplementing the odometer readings with actual pipe stationing.

Applications that stored quality indices within the resulting data documented the loading and alignment process.

Similar problems were experienced across most of the external data, including close-interval surveys, readings from test stations, and field inspections. A total of 25 new data types was introduced to the database, joining existing asset data.

Once the data were properly integrated in the shared pipeline database, the new risk application was able to read the data in the same format in which it was being stored within the data-management system, eliminating the need to consolidate and reformat the data, which previously took several months of work. The risk-analysis application also allowed the team to automate data preprocessing. These tasks having already been addressed, the company's risk-analysis team simply needed to configure the application to read the data it wanted and then run the analysis.

The data-integration process also put responsibility for the quality of data where it belonged: with its owners. Since the members of the risk team were not corrosion experts or particularly knowledgeable about the status of specific pipeline locations, they had never been able to qualify the data they were using.

The new streamlined approach also increased the reliability of the analysis. Users could see how specific points in the original data affected the risk scores. Reports with drill-down capabilities connected summary results back to the original data, rather than to a preprocessed version of the data as had previously occurred. If a user wanted to see why a specific risk score came out the way it did, they could click down through the report to explore the exact data interactions that lead to the calculation.

The time needed to run an analysis also decreased significantly, allowing the risk analysis team to discuss any data quality concerns with those maintaining it, explore dependencies between datasets by performing multiple runs of the analysis, and generally focus on risk analysis rather than acting as data detectives. ✦

The authors

Nick Park (npark@geofields.com) is vice-president, product management, at GeoFields Inc., joining GeoFields as director of applied technology in April 2001. He also teaches a course on pipeline data management throughout the year. Prior to joining GeoFields, Park worked for ERDAS Inc. in a variety of management positions including product management. Park holds an MS in geographical information systems from the University of Leicester and a BS from the University of Leeds, both in the UK.

Christopher Sanders (csanders@geofields.com) is a senior product specialist at GeoFields Inc., with expertise in product management, GIS, and pipeline integrity regulations. He also provides training, quality assurance, and technical support for a range of software applications. Sanders has 6 years' experience in the pipeline and GIS software industries. Prior to joining GeoFields, he was an acceptance testing engineer for Leica Geosystems and has also worked for the Northeast Georgia Regional Development Center as a GIS technician. Sanders holds a masters in forest resources and a graduate certificate in GIS from the University of Georgia.

Equipment/Software/Literature

Clamp speeds up panel saw setup, alignment

A quick-clamp assembly for the APS-438 air powered saw helps simplify setup and alignment on boiler tube panel fitup work and eliminates tack welding.

The PanelHog quick-clamp assembly for the saw comes with 2 in. wide steel track sections that attach securely using wedge-style clamps and has a cut-line indicator gauge to simplify setup and alignment. Permitting clean, straight cuts without rework, this rigid clamping assembly eliminates the need for tack welding tabs and hot spots.

Easily adjusted to fit all types of boiler tube panel sections, the clamp and 3 hp motor saw use fiberglass reinforced blades that can cut highly alloyed materials as thick as 4 in. The saw mounts to a bracket that glides along the track on four V-grooved steel wheels. Tracks come in 5-15 ft long sections.

Source: **ESCO Tool**, Box 530, Medfield, MA 02052.

New high-temperature flowmeters

New Micro Motion Coriolis high temperature flowmeter Models F025, F050, and F100 are now available in stainless steel or Hastelloy, all rated to 350° C.

Electronics for the new compact, drainable-style F-Series meters are attached at the end of a flexible conduit and away from the heat of the sensor.

Meters are especially suited to harsh operating environments and applications, such as heavy crude. Other applications include high temperature processes such as asphalt, bitumen, monomers, polymers, wax, and cooking oils that are difficult to control and keep below a set temperature limit.

Users can run heavy refined products hotter for a more productive and repeatable process, the company notes. And because meters have higher operating limits, there is no need to keep temperatures from exceeding an upper limit.

Micro Motion meters with patented MVD technology are flow rate independent, delivering stated accuracy without additional uncertainty caused by zero stability over the typical flow range.

Source: **Emerson Process Management**, Box 4100, St. Louis, MO 63136-8506.

Services/Suppliers

MacGregor Group AB

Gothenburg, Sweden, has announced formation of a new division, MacGregor Offshore. The division is built on two recently acquired companies, Hydramarine in Kristiansand, Norway, and Plimsoll, in Singapore. Both companies specialize in hydraulic and electrical deck machinery for ship owners, yards, and operators in the offshore industry. Hydramarine's key products are large active heave compensated cargo handling solutions including cranes, davits, winches, and subsea load handling equipment. Plimsoll's key products are winches and cranes for offshore and other marine applications.

Two other recent acquisitions provide the group with service capability on both sides of the North Sea. Those acquired service companies are Vestnorsk Hydraulikkservice AS, and Scottish company Grampian Hydraulics.

MacGregor Offshore division will be headed by general manager Henrik Vildenfeldt, former senior vice-president of corporate development in the MacGregor Group. Other members of the management team are Leif Byström, vice-president of operations; Ismo Matinlauri, director of after sales operations; Henry Yap, managing director of Plimsoll; Chai Chon Kim, executive director of Plimsoll; Vidar Robstad, managing director of Hydramarine; and Svein Erik Halvorsen, technical director of Hydramarine.

MacGregor Group, a member of Cargotec Corp., is a leading provider of engineering and service solutions for the maritime transportation industry.

Antares Offshore LLC

Houston, has announced the launch of PT Antaresindo Mandiri Utama, a subsidiary headquartered in Jakarta, Indonesia. Ricco Okvianto has been named director of PT Antares, with responsibility for day-to-day operations of the company, as well as developing the market.

Antares Offshore LLC is a consulting engineering company specializing in subsea field developments and marine pipeline project delivery.

Schlumberger

Houston, has announced its acquisition of Insensys Oil & Gas Ltd., a UK-based pioneer provider of non-intrusive fiber optic measurements for application in the integrity surveillance of subsea production systems.

Integration of Insensys' solutions with existing Schlumberger knowledge in the field will aid creation of unique product offerings to reduce technical risk in deepwater subsea developments.

Schlumberger is a leading global oil field services company supplying technology, information solutions, and integrated project management that optimize reservoir performance for customers in the oil and gas industry.

Southwestern Drilling Co., LP

Plano, Tex., has announced the appointments of Don R. White Sr. as corporate sales manager, David B. Perrin as operations manager, and William E. Suttle as drilling manager.

White has over 40 years of oil field experience, including 28 years with Smith International. He will be located in Kilgore, Tex.

Perrin has worked in drilling rig assembly and operations for Texas Wyoming Drilling, and Del Mar Drilling, during his 30-year career. Suttle spent the last 23 years of his oil field management career with Helmerich & Payne Inc. Both Perrin and Suttle will be located in Mineral Wells, Tex.

Southwestern Drilling Co., formed in 2005, operates in east and north central Texas.

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API IMPORTS OF CRUDE AND PRODUCTS

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	6-1 2007	[1]5-25 2007	6-1 2007	[1]5-25 2007	6-1 2007	[1]5-25 2007	6-2 2006
	1,000 b/d						
Total motor gasoline	391	641	134	26	525	667	476
Mo. gas. blending comp.	633	896	32	41	665	937	869
Distillate[2]	188	181	69	41	257	222	263
Residual	220	351	49	44	269	395	221
Jet fuel-kerosine	61	129	112	142	173	271	124
LPG	326	286	3	5	329	291	338
Unfinished oils	687	415	141	13	828	428	483
Other	596	537	—	3	596	540	415
Total products	**3,102**	**3,436**	**540**	**315**	**3,642**	**3,751**	**3,189**
Canadian crude	1,455	1,352	194	248	1,649	1,600	1,730
Other foreign	6,716	6,791	1,038	1,511	7,754	8,302	8,974
Total crude	**8,171**	**8,143**	**1,232**	**1,759**	**9,403**	**9,902**	**10,704**
Total imports	**11,273**	**11,579**	**1,772**	**2,074**	**13,045**	**13,653**	**13,893**

[1]Revised. [2]Includes No. 4 fuel oil.
Source: American Petroleum Institute.
Data available in OGJ Online Research Center.

PURVIN & GERTZ LNG NETBACKS—JUNE 1, 2007

Receiving terminal	Liquefaction plant					
	Algeria	Malaysia	Nigeria	Austr. NW Shelf	Qatar	Trinidad
	$/MMBtu					
Barcelona	6.79	4.23	6.02	4.14	5.39	6.00
Everett	6.45	4.35	6.04	4.44	4.91	6.74
Isle of Grain	3.21	1.33	2.65	1.24	1.84	2.72
Lake Charles	5.13	3.22	4.82	3.38	3.63	5.90
Sodegaura	4.68	6.48	4.88	6.43	5.80	4.19
Zeebrugge	5.55	3.47	4.90	3.39	3.99	4.93

Definitions, see OGJ Apr. 9, 2007, p. 57. Source: Purvin & Gertz Inc. 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.

OGJ CRACK SPREAD

	*6-1-07	*6-2-06	Change	Change, %
	$/bbl			
SPOT PRICES				
Product value	86.82	85.55	1.27	1.5
Brent crude	68.40	69.15	–0.76	–1.1
Crack spread	18.42	16.39	2.03	12.4
FUTURES MARKET PRICES				
One month				
Product value	88.83	87.67	1.16	1.3
Light sweet crude	63.93	71.50	–7.57	–10.6
Crack spread	24.89	16.17	8.72	54.0
Six month				
Product value	80.72	83.46	–2.74	–3.3
Light sweet crude	67.71	74.09	–6.38	–8.6
Crack spread	13.02	9.38	3.64	38.8

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

API CRUDE AND PRODUCT STOCKS

	Crude oil	Motor gasoline		Jet fuel Kerosine	Fuel oils		Unfinished oils
		Total	Blending comp.[1]		Distillate	Residual	
	1,000 bbl						
PAD I	14,511	52,118	24,987	10,650	43,175	14,619	8,107
PAD II	75,190	49,379	16,887	7,450	30,390	1,169	13,472
PAD III	188,299	68,802	26,987	13,204	34,262	13,495	43,726
PAD IV	14,043	6,366	1,889	600	3,210	267	2,861
PAD V	[1]54,393	31,876	21,791	9,584	13,830	5,976	22,338
June 1, 2007	**[1]346,436**	**208,541**	**92,541**	**41,488**	**124,867**	**35,526**	**90,504**
May 25, 2007[3]	**352,091**	**201,374**	**90,835**	**40,177**	**121,400**	**36,642**	**92,565**
June 2, 2006	**344,696**	**210,966**	**92,467**	**40,103**	**121,690**	**41,379**	**92,884**

[1]Included in total motor gasoline. [2]Includes 6,795 million bbl of Alaskan crude in transit by water. [3]Revised.
Source: American Petroleum Institute.
Data available in OGJ Online Research Center.

API REFINERY REPORT—JUNE 1, 2007

District	REFINERY OPERATIONS					REFINERY OUTPUT			
	Total refinery input	Crude runs	Input to crude stills	Operable capacity	Percent operated	Total motor gasoline	Jet fuel, kerosine	Fuel oils Distillate	Fuel oils Residual
	1,000 b/d					1,000 b/d			
East Coast	3,592	1,535	1,547	1,618	95.6	1,783	103	529	133
App. Dist. 1	100	91	95	95	100.0	57	0	34	0
Dist. 1 total	**3,692**	**1,626**	**1,642**	**1,713**	**95.9**	**1,840**	**103**	**563**	**133**
Ind., Ill., Ky.	2,250	2,055	2,084	2,355	88.5	1,305	138	595	40
Minn., Wis., Dak.	396	384	391	442	88.5	333	33	127	7
Okla., Kan., Mo.	926	750	758	786	96.4	511	30	303	6
Dist. 2 total	**3,572**	**3,189**	**3,233**	**3,583**	**90.2**	**2,149**	**201**	**1,025**	**53**
Inland Texas	771	446	469	647	72.5	416	33	154	7
Texas Gulf Coast	4,101	3,201	3,313	4,031	82.2	1,457	328	875	142
La. Gulf Coast	3,330	3,163	3,179	3,264	97.4	1,319	393	789	122
N. La. and Ark.	234	181	196	215	91.2	116	4	49	6
New Mexico	169	107	107	113	94.7	161	0	37	0
Dist. 3 total	**8,605**	**7,098**	**7,264**	**8,270**	**87.8**	**3,469**	**758**	**1,904**	**277**
Dist. 4 total	**621**	**505**	**520**	**596**	**87.3**	**289**	**23**	**155**	**13**
Dist. 5 total	**2,885**	**2,630**	**2,883**	**3,173**	**90.9**	**1,634**	**426**	**655**	**193**
June 1, 2007	**19,375**	**15,048**	**15,542**	**17,335**	**89.7**	**9,381**	**1,511**	**4,302**	**669**
May 25, 2007*	**19,459**	**15,061**	**15,578**	**17,335**	**89.9**	**9,242**	**1,394**	**4,194**	**668**
June 2, 2006	**18,065**	**15,919**	**16,305**	**17,115**	**95.3**	**9,053**	**1,394**	**4,077**	**603**

*Revised.
Source: American Petroleum Institute.
Data available in OGJ Online Research Center.

OGJ GASOLINE PRICES

	Price ex tax 6-30-07	Pump price* 5-30-07	Pump price 5-31-06
	¢/gal		
(Approx. prices for self-service unleaded gasoline)			
Atlanta	268.4	308.1	284.5
Baltimore	264.6	306.5	291.5
Boston	258.7	300.6	285.5
Buffalo	248.7	308.8	295.6
Miami	270.2	320.5	298.5
Newark	257.3	290.2	283.5
New York	252.9	313.0	293.9
Norfolk	259.4	297.0	286.5
Philadelphia	261.4	312.1	299.5
Pittsburgh	248.6	299.3	284.5
Wash., DC	275.8	314.2	304.5
PAD I avg.	260.5	306.4	291.6
Chicago	320.1	371.0	316.3
Cleveland	269.1	315.5	276.7
Des Moines	272.9	313.3	264.5
Detroit	275.8	325.0	280.5
Indianapolis	281.1	326.1	273.6
Kansas City	277.0	313.0	264.3
Louisville	279.9	316.8	281.3
Memphis	259.5	299.3	276.5
Milwaukee	286.6	337.9	281.5
Minn.-St. Paul	279.4	319.8	271.5
Oklahoma City	281.4	316.8	257.2
Omaha	278.9	325.3	271.3
St. Louis	272.9	308.9	255.7
Tulsa	277.3	312.7	254.5
Wichita	273.6	317.0	262.6
PAD II avg.	279.0	321.2	272.5
Albuquerque	309.6	345.9	277.2
Birmingham	262.9	301.6	271.9
Dallas-Fort Worth	267.4	305.8	282.8
Houston	265.6	304.0	281.3
Little Rock	258.2	298.4	270.5
New Orleans	262.3	300.7	275.9
San Antonio	259.1	297.5	266.9
PAD III avg.	269.3	307.7	275.2
Cheyenne	271.1	303.5	265.2
Denver	285.8	326.2	284.8
Salt Lake City	277.8	320.7	289.8
PAD IV avg.	278.2	316.8	279.9
Los Angeles	288.3	346.8	330.4
Phoenix	273.2	310.6	302.4
Portland	285.9	329.2	296.4
San Diego	288.6	347.3	337.4
San Francisco	313.3	371.8	335.4
Seattle	289.4	341.8	313.4
PAD V avg.	289.8	341.3	319.3
Week's avg.	**274.1**	**317.6**	**285.2**
May avg.	**264.1**	**307.6**	**288.5**
Apr. avg.	**234.7**	**278.3**	**270.5**
2007 to date	**213.0**	**256.6**	—
2006 to date	**208.5**	**251.3**	—

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

REFINED PRODUCT PRICES

	5-25-07 ¢/gal		5-25-07 ¢/gal
Spot market product prices			
Motor gasoline (Conventional-regular)		Heating oil No. 2	
New York Harbor	231.50	New York Harbor	194.16
Gulf Coast	235.00	Gulf Coast	198.91
Los Angeles	241.75	Gas oil	
Amsterdam-Rotterdam-Antwerp (ARA)	211.47	ARA	193.77
Singapore	213.02	Singapore	199.17
Motor gasoline (Reformulated-regular)		Residual fuel oil	
New York Harbor	247.50	New York Harbor	124.17
Gulf Coast	236.50	Gulf Coast	127.62
Los Angeles	253.75	Los Angeles	145.11
		ARA	119.29
		Singapore	128.28

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

BAKER HUGHES RIG COUNT

	6-1-07	6-2-06
Alabama	4	3
Alaska	8	9
Arkansas	43	23
California	31	34
Land	30	27
Offshore	1	7
Colorado	106	92
Florida	1	0
Illinois	0	0
Indiana	2	0
Kansas	12	6
Kentucky	8	6
Louisiana	175	198
N. Land	54	57
S. Inland waters	23	20
S. Land	30	38
Offshore	68	83
Maryland	0	0
Michigan	1	2
Mississippi	14	10
Montana	19	24
Nebraska	0	0
New Mexico	83	99
New York	5	6
North Dakota	34	32
Ohio	13	6
Oklahoma	194	182
Pennsylvania	14	17
South Dakota	4	2
Texas	843	742
Offshore	11	12
Inland waters	0	4
Dist. 1	19	22
Dist. 2	26	28
Dist. 3	60	68
Dist. 4	98	78
Dist. 5	180	129
Dist. 6	122	108
Dist. 7B	37	43
Dist. 7C	54	37
Dist. 8	110	90
Dist. 8A	25	24
Dist. 9	37	32
Dist. 10	64	67
Utah	37	40
West Virginia	34	25
Wyoming	79	96
Others—NV-2; TN-4; VA-3; WA-1	10	3
Total US	**1,774**	**1,657**
Total Canada	**136**	**293**
Grand total	**1,910**	**1,950**
Oil rigs	288	265
Gas rigs	1,484	1,389
Total offshore	81	103
Total cum. avg. YTD	**1,741**	**1,562**

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	6-1-07 Percent footage*	Rig count	6-2-06 Percent footage*
0-2,500	64	7.8	55	—
2,501-5,000	111	52.2	92	48.9
5,001-7,500	239	20.5	221	17.1
7,501-10,000	413	2.9	382	3.1
10,001-12,500	425	2.1	369	2.4
12,501-15,000	282	0.3	268	0.3
15,001-17,500	109	0.9	113	—
17,501-20,000	79	—	75	—
20,001-over	38	—	22	—
Total	**1,760**	**7.6**	**1,597**	**6.5**
INLAND	45		44	
LAND	1,650		1,482	
OFFSHORE	65		71	

*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]6-1-07	[2]6-2-06
	1,000 b/d	
(Crude oil and lease condensate)		
Alabama	18	19
Alaska	778	797
California	669	689
Colorado	50	63
Florida	6	7
Illinois	32	28
Kansas	95	100
Louisiana	1,362	1,250
Michigan	15	17
Mississippi	48	48
Montana	91	97
New Mexico	164	162
North Dakota	106	110
Oklahoma	164	172
Texas	1,317	1,323
Utah	45	48
Wyoming	143	128
All others	61	66
Total	**5,164**	**5,124**

[1]OGJ estimate. [2]Revised.

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

US CRUDE PRICES

$/bbl*	6-1-07
Alaska-North Slope 27°	50.90
South Louisiana Sweet	68.75
California-Kern River 13°	55.50
Lost Hills 30°	63.25
Southwest Wyoming Sweet	60.83
East Texas Sweet	61.25
West Texas Sour 34°	54.90
West Texas Intermediate	61.75
Oklahoma Sweet	61.75
Texas Upper Gulf Coast	58.50
Michigan Sour	54.75
Kansas Common	60.75
North Dakota Sweet	57.25

*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]	5-25-07
United Kingdom-Brent 38°	70.32
Russia-Urals 32°	67.22
Saudi Light 34°	66.40
Dubai Fateh 32°	66.17
Algeria Saharan 44°	72.97
Nigeria-Bonny Light 37°	72.98
Indonesia-Minas 34°	69.24
Venezuela-Tia Juana Light 31°	63.11
Mexico-Isthmus 33°	63.00
OPEC basket	67.70
Total OPEC[2]	67.39
Total non-OPEC[2]	65.99
Total world[2]	66.75
US imports[3]	63.11

[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]

	5-25-07	5-18-07	Change
	Bcf		
Producing region	768	740	28
Consuming region east	970	905	65
Consuming region west	315	301	14
Total US	**2,053**	**1,946**	**107**
	Mar. 07	**Mar. 06**	**Change, %**
Total US[2]	**1,603**	**1,692**	**–5.3**

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

Statistics

WORLDWIDE CRUDE OIL AND GAS PRODUCTION

	Mar. 2007	Feb. 2007	3 month average production 2007	3 month average production 2006	Change vs. previous year Volume	Change vs. previous year %	Mar. 2007	Feb. 2007	Cum. 2007
	Crude, 1,000 b/d						Gas, bcf		
Argentina	640	631	633	621	12	1.9	150.0	110.0	382.86
Bolivia	45	43	44	45	–1	–1.5	43.0	39.0	122.0
Brazil	1,769	1,758	1,754	1,692	62	3.7	29.0	26.0	83.0
Canada	2,686	2,607	2,621	2,495	126	5.0	517.2	506.7	1,556.7
Colombia	518	515	518	530	–11	–2.1	18.0	16.0	52.0
Ecuador	482	500	499	547	–48	–8.8	0.3	0.3	0.9
Mexico	3,182	3,148	3,158	3,344	–187	–5.6	183.0	162.7	523.5
Peru	103	114	112	109	3	2.9	6.6	5.4	17.7
Trinidad	125	124	123	151	–28	–18.4	118.0	107.1	338.3
United States	5,227	5,147	5,190	5,037	153	3.0	1,672.0	1,486.0	4,808.0
Venezuela[1]	2,390	2,430	2,437	2,630	–193	–7.4	75.0	70.0	225.0
Other Latin America	82	79	80	79	2	2.4	7.5	6.8	21.9
Western Hemisphere	**17,250**	**17,097**	**17,171**	**17,280**	**–110**	**–0.6**	**2,819.6**	**2,535.9**	**8,131.8**
Austria	17	17	17	17	—	–0.8	5.6	4.9	16.1
Denmark	321	306	315	326	–11	–3.2	16.7	29.6	78.7
France	20	17	18	21	–3	–13.6	3.3	3.0	9.6
Germany	70	70	70	72	–2	–3.3	55.0	52.0	165.1
Italy	107	114	109	113	–4	–3.8	31.0	28.0	89.8
Netherlands	30	30	33	30	3	9.9	400.0	375.0	1,175.0
Norway	2,391	2,454	2,425	2,629	–204	–7.7	268.4	257.8	813.3
Turkey	41	40	40	40	—	–0.7	0.0	3.1	6.5
United Kingdom	1,581	1,674	1,595	1,670	–75	–4.5	268.1	221.5	747.4
Other Western Europe	4	5	4	4	—	–2.1	3.4	3.1	9.6
Western Europe	**4,582**	**4,727**	**4,627**	**4,924**	**–297**	**–6.0**	**1,051.5**	**977.9**	**3,111.0**
Azerbaijan	750	850	817	567	250	44.1	28.0	20.0	72.0
Croatia	16	16	16	17	–1	–4.6	6.1	5.6	18.2
Hungary	17	18	17	18	–2	–8.3	7.7	7.1	22.8
Kazakhstan	1,250	1,200	1,217	983	233	23.7	80.0	80.0	240.0
Romania	98	98	98	100	–2	–2.3	18.0	16.6	53.0
Russia	9,700	9,750	9,717	9,333	383	4.1	2,000.0	1,900.0	6,000.0
Other FSU	400	400	400	517	–117	–22.6	480.0	400.0	1,360.0
Other Eastern Europe	49	50	49	49	—	–0.7	55.4	49.4	155.3
Eastern Europe and FSU	**12,280**	**12,382**	**12,330**	**11,585**	**745**	**6.4**	**2,675.2**	**2,478.8**	**7,921.4**
Algeria[1]	1,330	1,320	1,330	1,360	–30	–2.2	285.0	255.0	825.0
Angola[1]	1,658	1,614	1,618	1,423	195	13.7	2.5	2.3	7.3
Cameroon	85	85	85	90	–5	–5.7	—	—	—
Congo (former Zaire)	20	20	20	20	—	—	—	—	—
Congo (Brazzaville)	240	240	240	240	—	—	—	—	—
Egypt	660	660	660	693	–33	–4.8	42.0	38.0	122.0
Equatorial Guinea	320	320	320	320	—	—	0.1	0.1	0.2
Gabon	230	230	230	240	–10	–4.2	0.3	0.3	0.9
Libya[1]	1,690	1,690	1,693	1,667	27	1.6	22.0	19.5	63.5
Nigeria[1]	2,150	2,250	2,227	2,233	–7	–0.3	75.0	70.0	223.0
Sudan	450	450	450	393	57	14.4	0.0	0.0	0.0
Tunisia	95	89	92	65	27	41.1	7.0	6.4	20.6
Other Africa	262	262	262	266	–4	–1.6	10.2	9.6	29.9
Africa	**9,190**	**9,229**	**9,227**	**9,011**	**216**	**2.4**	**444.0**	**401.0**	**1,292.3**
Bahrain	170	170	170	175	–5	–2.9	26.6	24.0	77.6
Iran[1]	4,030	3,780	3,903	3,847	57	1.5	265.0	230.0	755.0
Iraq[1]	2,000	1,980	1,893	1,717	177	10.3	5.0	5.0	15.0
Kuwait[1,2]	2,425	2,420	2,435	2,515	–80	–3.2	31.0	28.0	90.0
Oman	720	720	723	753	–30	–4.0	58.0	52.0	168.0
Qatar[1]	780	800	797	820	–23	–2.8	110.0	100.0	325.0
Saudi Arabia[1,2]	8,405	8,460	8,475	9,332	–857	–9.2	155.0	140.0	455.0
Syria	390	390	393	440	–47	–10.6	16.0	14.4	46.4
United Arab Emirates[1]	2,570	2,540	2,570	2,613	–43	–1.7	135.0	120.0	390.0
Yemen	360	350	357	343	13	3.9	0.0	0.0	0.0
Other Middle East	—	—	—	—	—	–21.2	7.5	7.7	24.3
Middle East	**21,850**	**21,610**	**21,717**	**22,555**	**–838**	**–3.7**	**809.1**	**721.1**	**2,346.3**
Australia	374	485	428	354	74	20.9	110.0	100.0	320.0
Brunei	180	191	186	204	–19	–9.1	35.0	31.8	101.4
China	3,695	3,749	3,755	3,691	64	1.7	200.2	204.7	611.4
India	696	700	695	666	29	4.4	85.1	72.3	238.8
Indonesia[1]	850	840	850	923	–73	–7.9	183.0	165.0	533.0
Japan	19	19	19	18	1	4.0	11.4	10.0	33.7
Malaysia	740	740	753	770	–17	–2.2	138.0	125.0	403.0
New Zealand	20	15	17	14	2	16.3	11.0	10.0	31.5
Pakistan	65	65	65	65	—	–0.6	120.0	108.0	348.0
Papua New Guinea	50	55	53	58	–5	–8.0	0.5	0.5	1.5
Thailand	222	207	208	218	–10	–4.5	77.8	67.2	218.5
Viet Nam	350	340	340	353	–13	–3.8	15.0	13.5	43.5
Other Asia–Pacific	38	38	38	32	6	20.5	89.5	79.8	258.8
Asia Pacific	**7,298**	**7,443**	**7,406**	**7,367**	**40**	**0.5**	**1,076.6**	**987.7**	**3,143.0**
TOTAL WORLD	**72,450**	**72,489**	**72,478**	**72,722**	**–244**	**–0.3**	**8,876.0**	**8,102.5**	**25,945.8**
*OPEC	30,278	30,124	30,228	29,657	572	1.9	1,341.0	1,202.5	3,899.5
North Sea	4,311	4,449	4,352	4,641	–289	–6.2	672.9	621.1	1,991.1

[1]OPEC member. [2]Kuwait and Saudi Arabia production each include half of Neutral Zone. Totals may not add due to rounding.
Source: Oil & Gas Journal. Data available in OGJ Online Research Center.

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What? No global warming panic? How shocking!

An eminent prophet of global-warming doom is shocked that a colleague doesn't share his anxiety.

In a May 31 radio interview, Michael Griffin, administrator of the US National Aeronautics and Space Administration, raised questions about urgent responses to observed warming.

"I have no doubt that a trend of global warming exists," Griffin told National Public Radio. "I am not sure that it is fair to say that it is a problem we must wrestle with. To assume that it is a problem is to assume that the state of Earth's climate today is the optimal climate, the best climate that we could have or ever have had and that we need to take steps to make sure that it doesn't change.

"First of all, I don't think it's within the power of human beings to assure that the climate does not change, as millions of years of history have shown. And, second of all, I guess I would ask which human beings—where and when—are to be accorded the privilege of deciding that this particular climate that we have right here today, right now, is the best climate for all other human beings. I think that's a rather arrogant position for people to take."

So goes the maligned "skeptical" position on global warming. It's the position that regularly encounters claims that the debate is over and that if you don't "believe in global warming" and the need to do something radical about it then you're obviously wrong and don't deserve to be listened to.

Listening to Griffin on NPR, someone might get the heretical idea that warming doesn't warrant panic.

"I was shocked by his comments," responded James Hansen, head of NASA's Goddard Institute for Space Studies. Hansen figured prominently in former US Vice-President Al Gore's horror film about warming, An Inconvenient Truth. "It was a remarkable statement. I don't know if it was planned or it just slipped out of his mouth."

In a transcript, Griffin's statement doesn't read like a slip. It reads like a thoughtful and overdue appeal to examine global warming from a perspective other than the scariest imaginable.

(Online June 1, 2007; author's e-mail: bobt@ogjonline.com)

The Editor's Perspective

by Bob Tippee, Editor

Market Journal

by Sam Fletcher, Senior Writer

Natural gas nudges $8/MMbtu

The front-month natural gas contract was knocking at the $8/MMbtu level in intraday trading May 30-31 in New York, with investors expecting warmer temperatures across most of the US.

The July natural gas contract traded as high as $8/MMbtu on May 31 on the New York Mercantile Exchange before closing at $7.94/MMbtu, down just 0.06¢ for the day. By the close of trading June 1, it had dropped to $7.88/MMbtu. "Another triple digit storage injection offset forecasts for hotter weather," explained analysts at Enerfax Daily.

The Energy Information Administration reported the injection of 107 bcf of natural gas into US underground storage in the week ended May 25, up from 104 bcf the prior week. US gas storage totaled 2.1 tcf, down by 179 bcf from last year's total at that time but 355 bcf above the 5-year average.

That injection figure implied "that we are 1.9 bcfd looser year-over-year on a weather-adjusted basis," said analysts at Raymond James & Associates Inc. in Houston. "While an increasing price incentive to burn natural gas over crude derivatives is serving to boost gas demand, the positive fuel-switching impact has not been enough to offset LNG imports and liquid-stripping trends in the near term," they said.

The market also was preparing for the hurricane season, which began June 1.

Crude prices fluctuate

The front-month crude contract price fell to the lowest level in more than 2 months as NYMEX reopened May 29 after the 3-day Memorial Day weekend to an apparent easing of both global geopolitical tensions and refinery problems. The July contract for crude traded at $62.54-65.24/bbl before closing at $63.15/bbl, down by $2.05 for the day. By June 1, it had climbed back to $65.08/bbl.

EIA said commercial inventories of US benchmark light, sweet crudes fell 2 million bbl to 342.2 million bbl during the week ended May 25. Gasoline stocks increased more than expected, up 1.3 million bbl to 198 million bbl that week, but were still well below average for the summer driving season that began May 26-28. During the same week, total gasoline imports averaged 1.6 million b/d, the third-highest weekly average ever. Input of crude into US refineries dropped by 76,000 b/d to 15.6 million b/d, and utilization rates of US refineries remained relatively flat at 91.1% of capacity. "We find crude oil remaining undecided on its direction," said Olivier Jakob, Petromatrix GMBH, Zug, Switzerland.

Meanwhile, Raymond James analysts said, "With the Organization of Petroleum Exporting Countries itself struggling to bring fresh capacity online, overall growth in global oil supply appears barely sufficient to keep up with demand, let alone increasing excess capacity." Nor does it appear that non-OPEC producers will contribute any meaningful supply additions, given the mature characteristics of most of those fields. "Indeed, a permanent non-OPEC peak seems likely in the next 5-10 years. Non-OPEC growth is highly dependent on Russian growth and, given the current policy environment, Russia is unlikely to post the growth it experienced in the early part of this decade," they reported.

Raymond James reported, "The world is likely to continue in an environment of a wafer-thin excess capacity 'cushion' for the foreseeable future. Given this tight supply-demand equation, threats of even minor supply disruptions are bound to have a large impact on already volatile oil prices, and the oil markets look set to continue to price in a substantial geopolitical risk premium."

Jakob said imports of crude by China and India during April surpassed "for the first time ever" crude imports by South Korea and Japan. "As Japanese refineries come back from maintenance, this should remain for now a temporary situation, but this structural shift in the regional energy balance should continue and become more permanent over the next 2 years," he said. "Compared to April 2006, China and India crude imports have grown by about the same quantity. South Korea imports remain about unchanged, while Japan continues to import much lower volumes than last year."

Among Asian countries such as Japan and South Korea, Jakob said, refinery runs will now start to increase as refineries come out of the seasonal maintenance and should bring the region to new record high crude imports. "The real test to OPEC compliance [with its production quota] will come when Japanese crude oil demand starts to rise again, and indications from OPEC trackers are that OPEC supply is starting to slowly increase," he said.

(Online June 4, 2007; author's e-mail: samf@ogjonline.com)

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Welcome to the 19th annual Deep Offshore Technology (DOT) International Conference and Exhibition in Stavanger, Norway.

The industry is taking on new challenges in frontier areas and the Arctic is one of the new exciting frontiers now being explored. The challenges in these harsh conditions and the technology needed to succeed will be a focus in this year's DOT Conference, and will represent one of the "Oceans of New Opportunities".

The mature basins still have a lot to offer, thanks to important technological breakthroughs. These basins have, to a large extent, been used to qualify new technology that can now be further tested and used in frontier areas around the globe. The industry is going deeper, drilling through huge salt layers, tackling larger pressure reservoirs and establishing operations in harsh climates from the icy north to the windy Gulf of Mexico.

The DOT conference is a leading forum where attendees discuss important technical solutions related to exploration, development, and production of oil and gas in deep and ultra-deepwater. The forum provides you a unique opportunity to share and gain experience in your field of expertise. Through its long history, the DOT Conference has proven to be one of the most important conferences to meet your peers and experts and discuss technological innovations. The constant strive to improve safety, quality and economics are always the base for the discussions.

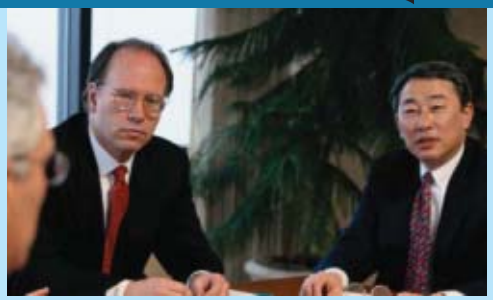
DOT also encourages the development of young professionals, as evidenced by 34% of papers authored by young petrotechs in DOT 2006 and has proven to be effective for newcomers to quickly gain an overview and understanding of key related technologies.

Statoil is proud to be the host for this year's conference. Statoil is a significant deepwater player, participating in ground-breaking current developments in frontier basins globally. Closer to home, our Snøhvit development in the Arctic is the first of its kind, and it has opened doors for a new era for the industry in these icy waters. Statoil is recognized for being a front-end developer and user of new technology, and the DOT Conference serves as an important arena to network with our partners regarding the development of technology.

Speaking on behalf of the Advisory Board, I believe this year's program will engage you, challenge you and benefit you. The International DOT gives you a unique opportunity to meet peers across borders and to enjoy the variety and international flavor Stavanger has to offer.

I look forward to seeing you in Stavanger, Norway this October.

Arnt Olufsen
Chairman
DOT 2007 Advisory Board



Deepwater & Arctic
Oceans of New Opportunities

The 19th Deep Offshore Technology International Conference & Exhibition (DOT) is scheduled for October 10 -12, 2007 and will be held at the Stavanger Forum in Stavanger, Norway. Statoil will host this event which promises to draw exhibitors and attendees from the oilfield centers in the North Sea, Russia, China, Asia, Europe, Africa, Brazil and the United States.

Norway's heritage of developing innovative technology for the deep offshore oil and gas exploration and production market makes Stavanger an ideal setting for the industry's largest conference dedicated to providing technical and operating information to the flourishing offshore and subsea markets.

Today, there are 48 fields in production on the Norwegian Continental Shelf and production from these fields corresponds to around 20 times the domestic consumption of petroleum and has established Norway as a key supplier to the global oil market and the lucrative European gas market.

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DOT Mission Statement

DOT is recognized as the leading forum addressing technical issues related to exploration, development, and production of oil and gas in deep and ultra deepwater basins around the world. As our industry confronts new challenges, the sharing of deepwater experience will play a critical role in improving the quality, safety, and economics of future endeavors.

The mission of DOT is to provide an annual forum dedicated to the advancement of the deepwater exploration & production. The conference addresses the technical challenges to safely and cost-effectively develop deepwater reserves, and encourages the development of young professionals.

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Claude Berbigier	*GEP*	**David Morgan**	*Cameron*
Bas Buchner	*MARIN*	**Alvaro Felippe Negrão**	*Repsol YPF E&P*
Bryce Campbell	*Eni Petroleum*	**Uri Nooteboom**	*INTEC Engineering*
Rene Casadaban	*Enterprise Products*	**Francesco Paone**	*Eni Gas B.V.*
Howard Cook	*BP Exploration & Production Inc.*	**Elisabeth Proust**	*TOTAL*
Loïc des Déserts	*Doris Engineering*	**Graham Sharland**	*Subsea 7*
Ian Frazer	*Acergy*	**Brian Skeels**	*FMC Technologies*
Chris Garcia	*Schlumberger*	**Bill Soester**	*J. Ray McDermott Engineering Inc.*
Ram Gopalkrishnan	*Shell International E&P*	**Pierre-Armand Thomas**	*Technip*
Paul Hansen	*Chevron*	**Arild Unneberg**	*Statoil*
Erwin Lammertink	*Heerema Marine Contractors*	**Claude Valenchon**	*Saipem*
Ole Lindefjeld	*ConocoPhillips*	**Mauricio Werneck de Figueiredo**	*Petrobras*
Jan T. Lisztwan	*Nexen Petroleum Intl. Company*		

Who Attends DOT

DOT is vital to industry leaders who seek information and emerging technology with which to plan future deepwater operations. DOT has a multi-national audience that provides a professional setting for making contacts and other business arrangements. DOT exhibitors have consistently recognized this conference as having the highest caliber of professionals in attendance. Exhibitors are exposed to technical specialists, key department managers, operating vice presidents, and leaders who influence purchasing decisions and bid lists.

Experts from around the world will gather in Stavanger to learn about the complexities of Arctic drilling. Attending DOT provides the opportunity to listen to topical discussions about:

- Projects and Lessons Learned
- Arctic Technology
- Subsea and Risers
- Drilling and Construction

The Conference

PennWell's DOT International Conference & Exhibition is a highly-focused event developed to provide maximum relevance and benefit for both exhibitors and attendees. This pivotal conference has grown to become the authoritative conference for key offshore E&P decision makers worldwide in that the information shared can be immediately be applied to most situations today and tomorrow.

DOT also provides a rich learning and marketing environment for exhibitors as the conference brings:

- A unique gathering of the worlds leading executives, managers, and engineers from major and independent E&P companies.
- Original reports on the current and future state of technology in this frontier environment delivered by key personnel involved in groundbreaking projects.
- A renewed focus on the ultra deepwater spectrum between 1,600 and 3,000 meters, viewed at the strategic level with case studies and reports on first-application technologies.
- An overview of the geopolitical and economic influences shaping the future of deepwater theaters around the globe with input from major independent and state-owned operators and producers.

Technical Focus Areas

- Arctic Drilling & Production
- Arctic Transportation
- Arctic HSE Issues
- Arctic Special Operating Requirements
- Lessons Learned – Field Development
- Lessons Learned in Deepwater Operations
- Frontier Areas
- Marginal Field Developments
- Workforce and Demographics
- Aging Deepwater Structures
- Redeployment of DW Assets
- Changing Market Dynamics
- Metocean (Hurricanes, Geotechnical)
- Riser Technology/Riser Fatigue
- Well Construction/Petroleum Technology
- Field Architecture and Economics
- Flowlines and Pipelines
- Completion Design in Deepwater
- Flow Assurance
- Station Keeping
- Project Execution and Management
- Model Testing
- Risk and Reliability
- Subsea Technology
- Advanced Materials
- Integrated Operations (e-Field)
- Seabed Boosting and Processing
- Construction/Installation
- Technology Qualification and Implementation
- Floating Facilities
- Long Distance Tiebacks
- Intervention

Exhibition

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Pre-register prior to 10 July 2007 at www.deepoffshoretechnology.com and save $US 100 on your full-conference registration

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Full Conference Registration includes:

- Admittance to all technical sessions
- Entrance to Exhibit Hall
- Conference Proceedings
- Daily luncheons and coffee breaks
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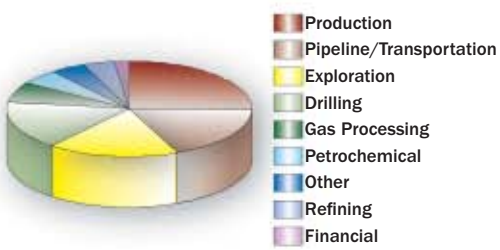
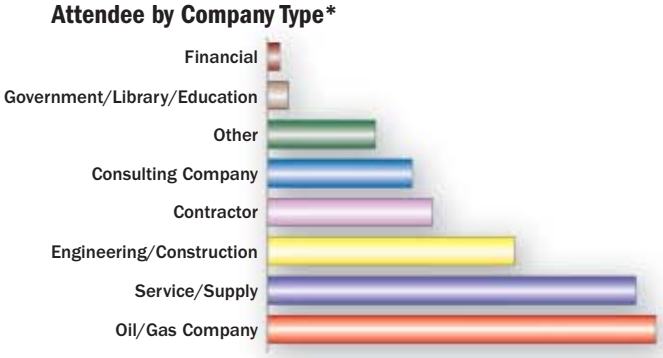
Deep Offshore Technology 2006 Attendee Profile

Attendee by Job Title*

Attendee Area of Interest*



Attendee by Company Type*



Attendee Purchasing Authority*

DEEP OFFSHORE TECHNOLOGY 2007
PRELIMINARY CONFERENCE PROGRAM

WEDNESDAY 10 OCTOBER 2007

Photo courtesy of ConocoPhillips

08:30 – 10:00 **OPENING PLENARY SESSION**

WELCOME & INTRODUCTION
*Eldon Ball – **PennWell Corporation***

STAVANGER WELCOME
Mayor Leif Johan Sevland

CHAIRMAN'S REMARKS
*Arnt Olufsen – **Statoil***

KEYNOTE ADDRESS
*Helge Lund – **CEO Statoil***

CONTRACTOR PERSPECTIVE
*Dag Jenssen – President, **Aker Kvaerner Deep Water Business Unit***

DRILLING CONTRACTOR PERSPECTIVE
*Geir Aune – Chairman of Board for **Ocean Rig***

10:00 – 10:30 **COFFEE BREAK** **Sponsored By:** FMC Technologies

WEDNESDAY 10 OCTOBER 2007

10:30 – 12:00 **SESSION 1**

TRACK 1 Floating Facilities ▪ Risers ▪ Construction & Installation

FLOATING FACILITIES 1
*Chair: Jack Mercier – **Global Maritime***
*Co-Chair: Pierre Armand Thomas – **Technip***

10:30 – 11:00 **Vessel Adapted for Deck Spar Installation and Removal**
*Jean-Marc Cholley – **Technip***

11:00 – 11:30 **Development of a Battered Four-Column TLP Concept for Deepwater Applications**
*Neil Williams – **SBM Atlantia***

11:30 – 12:00 **Regulatory Requirements for Drag Embedment Anchors**
*Roderick Ruinen – **Vryhof***

Alternate: **Improved Tools for Robust Prediction of Wave Impact on Offshore Floating Installations in Extreme Storms**
*Carl Trygve Stansberg – **Marintek***

TRACK 2 Subsea Technology ▪ Well Construction ▪ Flow Assurance

SUBSEA TECHNOLOGY 1
*Chair: Brian Skeels – **FMC Technologies***
*Co-Chair: Dave Lucas – **ExxonMobil***

10:30 – 11:00 **Practical Challenges of Manufacturing a High Voltage & High Pressure Inter Boundary (HVPIB) Connector (Penetrator) for a 2500 KW Subsea Motor**
*Tony Kenyon – **Hayward Tyler Ltd.***

11:00 – 11:30 **Retrofit Installation of DEH for Plug Removal in Deepwater and Arctic Environment – Ormen Lange Application**
*Atle Harald Bornes – **Statoil***

11:30 – 12:00 **Ormen Lange – Large Bore Tie-In**
*Simen Moxnes – **Hydro***

Alternate: **Challenges and Lessons Learned of Complex Spoolpiece Design and Installation in Deepwater Angola**
*Joseph Clements – **Technip***

TRACK 3 Arctic Technology ▪ Lessons Learned ▪ Special Sessions

ARCTIC TECHNOLOGY 1
*Chair: Arild Unneberg – **Statoil***
Co-Chair: Ram Gopalkrishnan – ***Shell International E&P***

10:30 – 11:00 **Environmental Challenges in the Arctic**
*Speaker TBD – **GAZPROM***

11:00 – 11:30 **Main Principles of Subsea Technological Solutions for the Arctic**
*Speaker TBD – **Vniigaz***

11:30 – 12:00 **International Standards, ISO, for Arctic Installations**
*Speaker TBD – **BP** (ISO committee member)*

Alternate: **The Challenges Facing Subsea Marine Operations in the Arctic and Sub-Arctic Regions**
*Thore Groenvik – **Acergy***

12:00 – 13:30 **LUNCH**

WEDNESDAY 10 OCTOBER 2007

13:30 – 15:00 **SESSION 2**

TRACK 1 Floating Facilities ▪ Risers ▪ Construction & Installation

RISERS 1
*Chair: Uri Nooteboom – **INTEC Engineering***
Co-Chair: *Jan. T. Lisztwan – **Nexen Petroleum Intl. Company***

13:30 – 14:00 How to Play an Instrument Circumventing Resonances? Asgard B's Battle with Flow-Induced Pulsations in the Gas Export System
*Trond Stokka Meling – **Statoil***

14:00 – 14:30 Wake Instability from a Cylinder Subject to VIV
*Jean-Francois Saint-Marcoux – **Acergy***

14:30 – 15:00 Inspection Considerations for Deepwater Thick-Walled Riser Systems
*Hugh Thompson – **Chevron***

Alternate: Titanium Segment Evaluation at Touch Down Zone of Deepwater Steel Catenary Risers
*Carl Baxter – **RTI Energy Systems***

TRACK 2 Subsea Technology ▪ Well Construction ▪ Flow Assurance

SUBSEA BOOSTING AND PROCESSING 1
*Chair: Dave Lucas – **ExxonMobil***
*Co-Chair: Arnt Olufsen – **Statoil***

13:30 – 14:00 Subsea Oil/Water Separation: Overview of the Main Processing Challenges
*Roberto Oliveira – **Petrobras***

14:00 – 14:30 Tyrihans Subsea Raw Seawater Injection
*Audun Grynning – **Aker Kvaerner Subsea***

14:30 – 15:00 SWIT - Seabed Based Water Injection and Treatment
*Jan Olav Hallset – **Poseidon Innovation AS***

Alternate: Subsea Pump Condition Monitoring and Intervention Prediction Techniques
*Klaus Ericksson – **Aker Kvaerner Subsea AS***

TRACK 3 Arctic Technology ▪ Lessons Learned ▪ Special Sessions

LESSONS LEARNED 1
*Chair: Ole Lindefjefd – **ConocoPhillips***
*Co-Chair: Elisabeth Proust – **TOTAL***

13:30 – 14:00 Sand Production Management for Snorre B Subsea Development Lessons Learned and Actions Taken
*Kjell Lejon – **Statoil***

14:00 – 14:30 Environmentally Friendly Production Drilling in the Barents Sea - Experiences from the Snohvit Field Development
*Georg Vidnes – **Statoil***

14:30 – 15:00 Record Breaking Umbilical Installations - Installation Analysis Lessons Learned
*Eldho Paul – **Subsea 7***

Alternate: Real-Time Dynamic e-field Solution Brings Flow Assurance Technology to Operations in Offshore West Africa
*Javier M. Canon – **SPT Group***

15:00 – 15:30 **COFFEE BREAK** **Sponsored By:** FMC Technologies

WEDNESDAY 10 OCTOBER 2007

15:30 – 17:00 **SESSION 3**

TRACK 1 Floating Facilities ▪ Risers ▪ Construction & Installation

FLOWLINES & PIPELINES 1
*Chair: Claude Valenchon – **Saipem***
*Co-Chair: Graham Sharland – **Subsea 7***

15:30 – 16:00 Offshore Installation of Remotely Operated Repair Clamp for High Pressure, High Temperature Subsea Pipelines
*Richard Verley – **Statoil***

16:00 – 16:30 Saipem Group Experience on the Design of Deepwater Flowlines: Some Design Considerations on Pipewalking Issues
*Paolo Monti - **Saipem Energy International***

16:30 – 17:00 Pipeline Designs for Strain Based Applications
Mike S. Weir – ExxonMobil

Alternate: Real-Time Integrity Monitoring of Deepwater Flowlines
*Donald Thomson – **Insensys Oil & Gas***

TRACK 2 Subsea Technology ▪ Well Construction ▪ Flow Assurance

WELL CONSTRUCTION / COMPLETION TECHNOLOGY
*Chair: Bill Soester – **J Ray McDermott Engineering Inc.***
*Co-Chair: Ron Araujo – **Anadarko***

15:30 – 16:00 Every Minute Counts - Deepwater Completions, Offshore Brazil
*Francisco Pineda – **BJ Services***

16:00 – 16:30 Collapse Analysis of Screens Used in Horizontal Open Hole Completion
*Anderson Rapello dos Santos – **Petrobras***

16:30 – 17:00 A Novel Offshore Slot-Recovery Method Using Direct Hydraulic Expansion to Re-Connect Casing with an External Casing Patch
*Neil Thomson – **Read Group***

Alternate: Jet Systems Acidizing in a Campos Basin Deepwater Horizontal Gravel Packed Injection Well
*Alexandre Z.I. Pereira – **Petrobras***

TRACK 3 Arctic Technology ▪ Lessons Learned ▪ Special Sessions

TECHNOLOGY QUALIFICATION AND IMPLEMENTATION
*Chair: Arnt Olufsen – **Statoil***
*Co-Chair: Paul Hansen – **Chevron***

15:30 – 16:00 Technology Qualification in Tordis IOR Project
*Rune Mode Ramberg – **Statoil***

16:00 – 16:30 Statoil Subsea IOR Research and Development - Well Operations in Deepwater
*Per Kristian Munkerud – **Statoil***

16:30 – 17:00 Achieving Reliability Through Deepwater Subsea Equipment Standardization: Outline of Proactive Processes & Tools
*M. G. Starkey and C. S, Horan – **ExxonMobil***

Alternate: Well Systems Centered Dry Tree Semisubmersible FPU
*Dr. Chunfa Wu – **WP Sea, Inc.***

18:00 - 19:30 **EXHIBITION HALL NETWORKING RECEPTION** **Sponsored by:** STATOIL

THURSDAY 11 OCTOBER 2007

08:30 – 10:00 **SESSION 4**

TRACK 1 Floating Facilities ▪ Risers ▪ Construction & Installation

FLOATING FACILITIES 2
*Chair: Alvaro Negrão – **Respsol YPF E&P***
*Co-Chair:Jens Joergen Madsen – **Maersk Contractors***

08:30 – 09:00 Moored Floater Responses to Arctic and Sub-Arctic Ice Conditions
*John Murray – **FloaTEC***

09:00 – 09:30 Offshore Classification Challenges for Floating Drilling and Production Platforms for Cold Climate Operations
*Erik A.M. Henriksen – **DNV***

09:30 – 10:00 Disconnectable Production Facilities for Arctic Conditions
*Yann Bouger – **Aker Subsea***

Alternate: Improved Tools for Robust Prediction of Wave Impact on Offshore Floating Installations in Extreme Storms
*Carl Trygve Stansberg – **Marintek***

TRACK 2 Subsea Technology ▪ Well Construction ▪ Flow Assurance

SUBSEA TECHNOLOGY 2
*Chair: David Morgan – **Cameron***
*Co-Chair: Ken Bayne – **Murphy E&P Co.***

08:30 – 09:00 Subsea Control System MMX - 2010. The Next Generation
*John A. Johansen – **FMC/Statoil***

09:00 – 09:30 Challenges for Subsea Control Systems to Operate 20,000 psi High Pressure Fields
*Stefan Knepper – **Cameron***

09:30 – 10:00 Subsea Profilers Dynamic Process Mapping of Subsea Vessels
*Paul Featonby – **Tracerco***

Alternate: Leak Location and Sealing Using Platelet Technology
*Klaire Evans – **Brinker Technology***

TRACK 3 Arctic Technology ▪ Lessons Learned ▪ Special Sessions

LESSONS LEARNED 2
*Chair: Paul Hansen – **Chevron***
*Co-Chair: Elisabeth Proust – **TOTAL***

08:30 – 09:00 Golfinho Field Early Production System - The Flow Assurance Challenge
*Romulo Cobe Vasconcelos – **Petrobras***

09:00 – 09:30 Mid-Water Bonded Rubber Hoses for Bonga Oil Offloading Riser
*Philippe Lavagna – **SBM***

09:30 – 10:00 Distributed Temperature Monitoring of Flexible Risers on Dalia Field
*S. Jacquemin – **Technip***

Alternate: Challenges and Lessons Learned of Complex Spoolpiece Design and Installation in Deepwater Angola
*Joseph Clements – **Technip***

10:00 – 10:30 **COFFEE BREAK** **Sponsored By:** FMC Technologies

THURSDAY 11 OCTOBER 2007

10:30 – 12:00 **SESSION 5**

TRACK 1 Floating Facilities ▪ Risers ▪ Construction & Installation

RISERS 2
*Chair: Howard Cook – **BP Exploration & Production Inc.***
*Co-Chair: Ian Frazer – **Acergy***

10:30 – 11:00 Composite Material Drilling Riser – Experience from Six Years in Operation
*Bjorn Melve – **Statoil ASA***

11:00 – 11:30 Effect of Drilling Riser Choke and Kill Line Gap Closure on VIV Fatigue
*Himanshu Gupta Ph.D – **BP***

11:30 – 12:00 Fatigue Life Assessment of a Drilling Riser Containing Corrosion Patches
*George Carneiro Campello – **Petrobras***

Alternate: Comparison of Measured and Predicted Fatigue Damage Results from a North Sea Completion/ Workover Riser Management System
*Donogh Lang – **MCS***

TRACK 2 Subsea Technology ▪ Well Construction ▪ Flow Assurance

SUBSEA BOOSTING AND PROCESSING 2
*Chair: Ram Gopalkrishnan – **Shell Exploration & Production***
*Co-Chair: David Morgan – **Cameron***

10:30 – 11:00 The First Riser Deployed ESP in the Gulf of Mexico
*Tiffany Pitts – **Baker Hughes Centrilift***

11:00 – 11:30 Integration of New Subsea Technology to Existing Infrastructure
*Arthur Jan Pettersen – **Acergy***

11:30 – 12:00 Challenges When Incorporating Subsea Boosting Systems in Brownfields
*Asbjorn Paulsen – **VetcoGray***

Alternate: Decanter Well: Subsea Gas-Liquid Separation and Boosting Technology for Deepwater
*Kjersti Hallingstad – **FMC***

TRACK 3 Arctic Technology ▪ Lessons Learned ▪ Special Sessions

ARCTIC TECHNOLOGY 2
*Chair: Bas Buchner – **MARIN***
*Co-Chair: Jens Joergen Madsen – **Maersk Contractors***

10:30 – 11:00 Arctic Tandem Offloading Terminal
*Speaker TBD: **Barlindhaug***

11:00 – 11:30 Ice Management and Ice Load Design – Offshore Canada
*Speaker TBD – **PetroCanada***

11:30 – 12:00 Arctic Drillship - A Concept Solution
Speaker – TBD

Alternate: The Challenges Facing Subsea Marine Operations in the Arctic and Sub-Arctic Regions
*Thore Groenvik – **Acergy***

12:00 – 13:30 **LUNCH** **Sponsored by:** Norwegian Centres of Expertise NCE Subsea

THURSDAY 11 OCTOBER 2007

13:30 - 15:00 **SESSION 6**

TRACK 1 Floating Facilities ▪ Risers ▪ Construction & Installation

FLOWLINES & PIPELINES 2
*Chair: Graham Sharland – **Subsea 7***
*Co-Chair: Howard Cook – **BP Exploration & Production Inc.***

13:30 – 14:00 Breaking Pipeline Frontiers on Uneven Seabed – the Ormen Lange Experience
*Finn Gunnar Nielsen – **Hydro***

14:00 – 14:30 Installation of Flowline and SCR from 'Seven Oceans' – Subsea 7's New Deepwater Reel Lay Vessel
*Geir Hammer and Reinert Hansson – **Subsea 7***

14:30 – 15:00 High Performance Pipe-in-Pipe Solution for Deepwater Field Developments
*Loic Delebecque – **Saipem***

Alternate: Installation of Langeled Pipleline from Nyhavna in Norway to Easington in the UK
*Ragnar Hjelmen – **Statoil***

TRACK 2 Subsea Technology ▪ Well Construction ▪ Flow Assurance

WELL CONSTRUCTION/DRILLLING TECHNOLOGY 1
*Chair: Chris Garcia – **Schlumberger***
*Co-Chair: Mauricio Werneck de Figueiredo – **Petrobras***

13:30 – 14:00 An Expandable Liner Hanger for Casing-to Liner Conversion
*Peter Wood – **Read Group***

14:00 – 14:30 BHA Design for Drilling Directional Holes in Salt in Deepwater Gulf of Mexico
*Tony Leavitt – **Schlumberger***

14:30 – 15:00 Through Tubing Rotary Drilling in Subsea Wells
*Tore Geir Wermo – **Statoil***

Alternate: The Atlantis Artificial Seabed and its First Well Use
*Arne Johansen – **Atlantis***

TRACK 3 Arctic Technology ▪ Lessons Learned ▪ Special Sessions

RISK AND RELIABILITY MANAGEMENT
*Chair: Elisabeth Proust – **TOTAL***
*Co-Chair: Loïc des Déserts – **DORIS Engineering***

13:30 – 14:00 OSTRA JIP – Building the Offshore Subsea Technology Reliability Database for Angola
*Michel Vache – **DORIS/ADC***

14:00 – 14:30 Environmental Advances in Drilling Fluids and Waste Handling for Arctic Drilling Operations
*Jan Thore Eia – **MI-SWACO***

14:30 – 15:00 Drilling Riser, Wellhead and Conductor Structural Integrity Management in New and Remote Offshore Regions
*Tim Farrant – **BP***

Alternate: A Comprehensive Engineering Data Acquisition Program for the Sakhalin IV and V Licence Areas
*Denis Blanchet – **BP***

15:00 - 15:30 **COFFEE BREAK** **Sponsored By:** FMC Technologies

THURSDAY 11 OCTOBER 2007

15:30 - 17:00 **SESSION 7**

TRACK 1 Floating Facilities ▪ Risers ▪ Construction & Installation

CONSTRUCTION/INSTALLATION 1
*Chair: Erwin Lammertink – **Heerema Marine Contractors U.S. Inc.***
*Co-Chair: Francesco Paone – **Eni Gas B.V.***

15:30 – 16:00 **Deepwater Construction with the Balder – 5 Years of Experience**
*Jan Van der Graaf – **Heerema Marine Contractors***

16:00 – 16:30 **Installation of Reeled Rigid Pipelines Connected to Large and Heavy Subsea Structure as First End and Ultra Deepwater**
*Marcelo Xavier – **Subsea 7***

16:30 – 17:00 **Installation of a Very Ambitious Pipe-in-Pipe Flowline Project**
*Bas Zoon – **Heerema Marine Contractors***

Alternate: **Roncador Manifolds Installation by the Pendulous Method**
*Pedro Felipe Katrein Stock – **Petrobras***

TRACK 2 Subsea Technology ▪ Well Construction ▪ Flow Assurance

FLOW ASSURANCE
*Chair: Ron Araujo – **Anadarko***
*Co-Chair: Alvaro Felippe Negrão – **Repsol YPF***

15:30 – 16:00 **Methodology for Evaluating Flow Assurance Risks**
*Henning Holm – **Hydro***

16:00 – 16:30 **Multiphase Transport with Hydrate Formation**
*Harald Kvandal – **Hydro***

16:30 – 17:00 **From Deepwater to the Arctic with Flow Assurance Technology**
*Leonid Dykhno – **Shell Global Solutions***

Alternate: **Subsea Single Production Line Hydrate Management Strategy Utilizing Depressurization and Dead Crude with Anti-Agglomerates Displacement via an Umbilical Service Line**
*Richard F. Stoisits – **ExxonMobil***

TRACK 3 Arctic Technology ▪ Lessons Learned ▪ Special Sessions

SPECIAL SESSION 1
*Chair: Loïc de Déserts – **DORIS Engineering***
*Co-Chair: Ole Lindefjeld – **ConocoPhillips***

15:30 – 16:00 **Demo 2000 Stepping up in Deepwater and Arctic**
*Morten Wiencke – **Research Council of Norway***

16:00 – 16:30 **Overview of US Department of Energy Ultra-Deepwater R&D Initiative**
*Chris Haver – **Chevron***

16:30 – 17:00 **Ultra-Deepwater Developments – The Independents Perspective**
*Timothy Powell – **Devon***

Alternate: **Key Technology to unlock Massive Hydrocarbon Resources in Ultradeepwater and Arctic Regions**
*Richard D'Souza – **Granherne Americas***

FRIDAY 12 OCTOBER 2007

08:30 – 10:00 **SESSION 8**

TRACK 1 Floating Facilities ▪ Risers ▪ Construction & Installation

RISERS 3
*Chair: Ian Frazer – **Acergy***
*Co-Chair: Claude Valenchon – **Saipem***

08:30 – 09:00 The Bundle Hybrid Offset Riser – A Novel Riser Tower Concept for the Development of ROSA Field
*Giulio Fatica – **Saipem***

09:00 – 09:30 Model Test Investigation of Air Can VIM of Free Standing Risers
*Jaap de Wilde – **MARIN***

09:30 – 10:00 Grouped SLOR Deepwater Riser System
*Daniel Karunakaran – **Subsea 7***

Alternate: Titanium Segment Evaluation at Touch Down Zone of Deepwater Steel Catenary Risers
*Carl Baxter – **RTI Energy Systems***

TRACK 2 Subsea Technology ▪ Well Construction ▪ Flow Assurance

WELL CONSTRUCTION / DRILLING TECHNOLOGY 2
*Chair: Ken Bayne – **Murphy E&P** Co.*
*Co-Chair: Claude Berbigier – **GEP***

08:30 – 09:00 Case Study of New Slender Well Construction Technology
*Paul Howlett – **CALEDUS***

09:00 – 09:30 Managing Zonal Isolation Risk Through Use of a New Responsive Cement Material
*Carl Johnson – **Schlumberger***

09:30 – 10:00 High-Collapse Tubulars Address Common Problems Found in Extreme Conditions
*Tony Furniss – **Enventure***

Alternate: Options in Deepwater Drilling
*Rupak Ghosh – **BP***

TRACK 3 Arctic Technology ▪ Lessons Learned ▪ Special Sessions

ARCTIC TECHNOLOGY 3
*Chair: Jan Lisztwan – **Nexen Petroleum Intl. Company***
*Co-Chair: Brian Skeels – **FMC Technologies***

08:30 – 09:00 Long Arctic Subsea Tie Back Control Buoy
*Speaker TBD – **Total***

09:00 – 09:30 Multiphase Flow Assurance Design for Long Gas-Condensate Pipelines
*Speaker TBD – **Statoil***

09:30 – 10:00 Subsea to Beach Shallow Water, Tie-back System in Seasonal Ice Floes
*Speaker TBD – **FMC***

Alternate: The Challenges Facing Subsea Marine Operations in the Arctic and Sub-Arctic Regions
*Thore Groenvik – **Acergy***

10:00 - 10:30 **COFFEE BREAK** **Sponsored By:** FMC Technologies

FRIDAY 12 OCTOBER 2007

10:30 - 12:00 **SESSION 9**

TRACK 1 Floating Facilities ▪ Risers ▪ Construction & Installation

CONSTRUCTION/INSTALLATION 2
*Chair: Francesco Paone – **Eni Gas B.V.***
*Co-Chair: Jack Mercier – **Global Maritime***

10:30 – 11:00 Spar Topsides Floatover Installation – Structural Design and Analyses
*Michael Y.H. Luo – **Technip***

11:00 – 11:30 Installation of Mini-TLP's: Opportunities for Optimization
*Richard Zoontjes – **Heerema Marine Contractors***

11:30 – 12:00 Deployment of Subsea Module with use of Nylon Rope on the Agbami Field
*Kirsti Gaupseth – **Subsea 7***

Alternate: Roncador Manifolds Installation by the Pendulous Method
*Pedro Felipe Katrein Stock – **Petrobras***

TRACK 2 Subsea Technology ▪ Well Construction ▪ Flow Assurance

SUBSEA BOOSTING AND PROCESSING 3
*Chair: Mauricio Werneck de Figueiredo – **Petrobras***
*Co-Chair: Chris Garcia – **Schlumberger***

10:30 – 11:00 Prevention of Biofouling on Subsea Heat Exchanger
*Janiche Beeder – **Hydro***

11:00 – 11:30 Multi-Pipe Separators – A Novel Approach to Deepwater Subsea Separation
*Roberto Di Silvestro – **Saipem***

11:30 – 12:00 Developing a Prototype 12.5MW Subsea Gas Compressor
*Bernt Bjerkreim – **Hydro***

Alternate: ECO-II: The Seal-Less Compressor
*Robert Nijhuis – **Siemens***

TRACK 3 Arctic Technology ▪ Lessons Learned ▪ Special Sessions

SPECIAL SESSION 2
*Chair: Claude Berbigier – **GEP***
*Co-Chair: Arild Unneberg – **Statoil***

10:30 – 11:00 Russian Oilfield Services Market
*John Westwood – **Douglas Westwood***

11:00 – 11:30 Extending Deepwater Technology to Unlock Arctic and Cold Region Reserves
*David Hamilton – **BP***

11:30 – 12:00 Goliat Field Development
*Speaker TBD – **Eni***

Alternate: How Deep Can You Go?
***Speaker TBD** – BP*

12:00 – 13:30 **LUNCH**

13:30 – 15:00 **CHAIRMAN'S CLOSING REMARKS**
AWARDS CEREMONY
CLOSING REMARKS AND PASSING OF THE TORCH TO THE 2008 HOST COMPANY

DOT 2006 George Murray Award Recipients

BEST PRESENTATION

Presenter: ***Tale Ulstein***
Company: ***Subsea 7***
Presentation: **Installation of Lightweight Deepwater Umbilical in Strong Current on Uneven Seabed**

TECHNICAL INNOVATION AWARD

Presenter: ***Charlie Tyrrell***
Company: ***Shell Int. E & P Inc.***
Presentation: **ROV - Based Opening of FBIV**

GEORGE MURRAY MEMORIAL YOUNG ENGINEER AWARD

Presenter: ***Garrett J. Atkins***
Company: ***ExxonMobil Development Co.***
Presentation: **Extension of Deepwater Riser Fatigue Life through Use of Nickel Based Welding Consumables**

Registration Hours

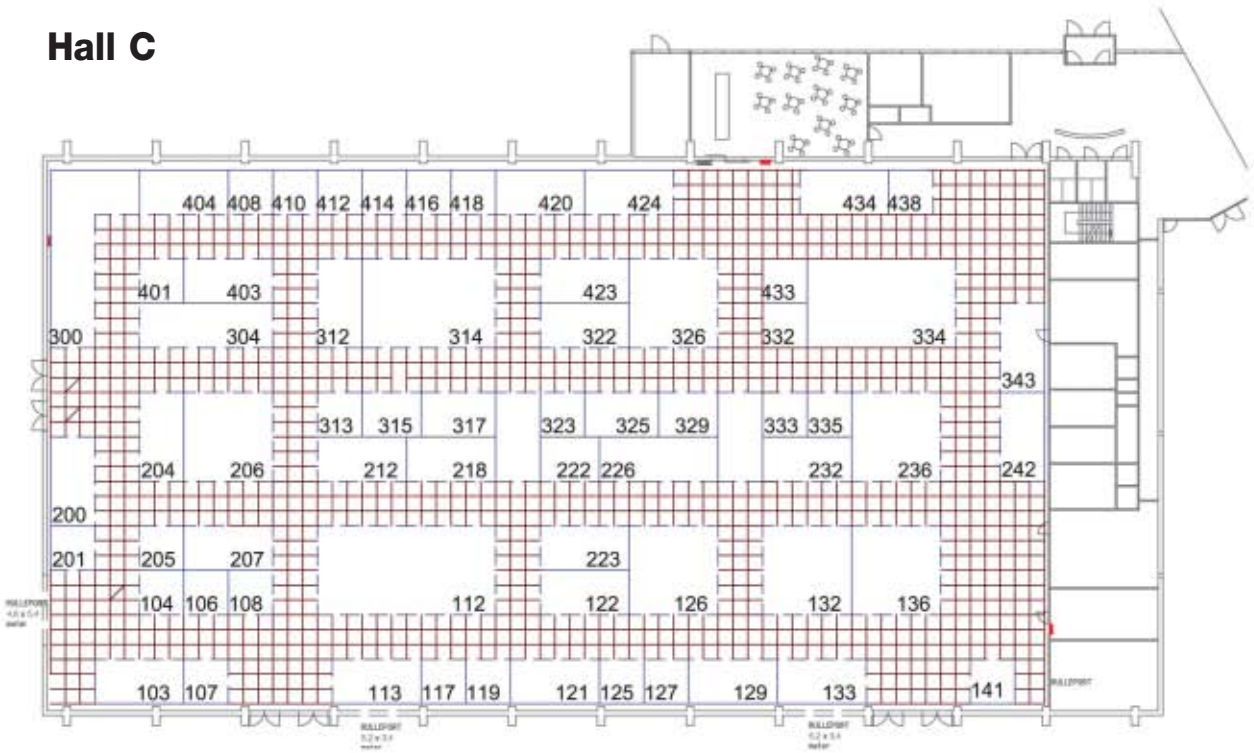
- Tuesday 9 October 13.00 – 18.00
- Wednesday 10 October 07.30 – 19.30
- Thursday 11 October 08.00 – 18.30
- Friday 12 October 08.00 – 15.00

Exhibition Hours

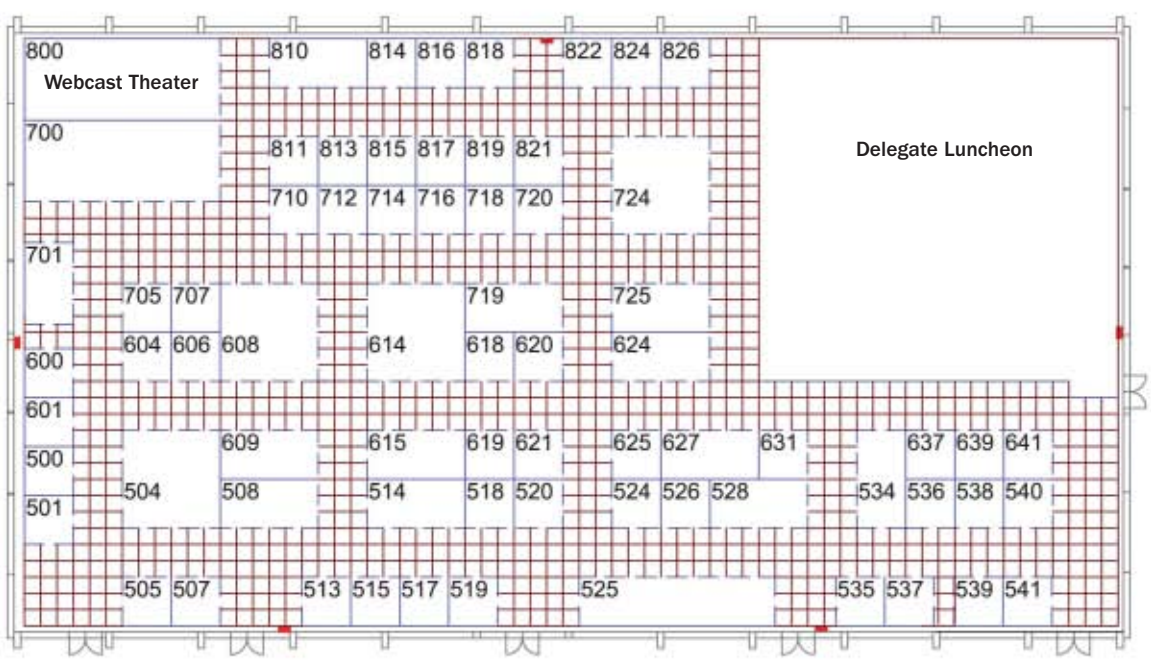
- Wednesday 10 October 10:00 – 19:30
- Thursday 11 October 10:00 – 18:30
- Friday 12 October 10:00 – 15:00

2007 Floor Plan

Hall C



Hall D



DOT 2007 Exhibitors List *(as of 25 May 2007)*

- 3M Oil & Gas
- Acergy
- Acteon
- Ansys
- Balltec Ltd.
- Balmoral Offshore Engineering
- Bayou Flow Technologies
- Bel Valves Ltd.
- BMT Scientific Marine Services, Inc.
- BPP Technical Services Ltd.
- Bredero Shaw
- Brinker Technology
- Cameron
- Castrol Offshore Limited
- CD-Adapco
- Champion Environmental Technologies
- ClampOn AS
- Clarkson Research Services Ltd.
- CorrOcean
- D.G.O'Brien
- Dagens Næringsliv
- Deepsea Engineering Ltd
- Det Norske Veritas
- Diamould Ltd.
- Dominion Technology Gases Ltd
- Dril-Quip
- Energy Industries Council
- Enventure Global Technology
- Exmar Offshore Company
- Flexlife
- Flotation Technologies
- FMC Technologies
- FPS Ocean AS
- Framo Engineering AS
- GEP
- Hayward Tyler Ltd.
- Heerema
- Huisman
- Hydratight
- Imaresh
- Infield Systems
- INTEC Engineering
- Lankhorst / Mouldings
- Lincoln Electric
- Mardale Pipes Plus Ltd.
- MARINTEK / SINTEF
- Matre/Tronic
- MCS
- MODEC
- Moorlink AB
- NCE Subsea
- Nexans
- Odim Alitec AS
- Oil States Industries
- Optical Metrology Services Limited
- OTM Consultancy (SUS/SEAFOM)
- Polyoid Ltd.
- Proclad
- Prosafe
- Ramnas Bruck AB
- Read Well Services Ltd.
- Remora ASA
- RTI Energy Systems
- Saipem
- Samson
- SAS Gouda B.V.
- SBM Offshore
- ScanRope AS
- Schlumberger
- Sevan Marine
- Socotherm S.P. A.
- Sonamet
- SPT Group
- Statoil
- Stork Gears & Services
- Subsea 7
- Techlam - Paulstra
- Technip Norge AS
- The Cortland Companies
- The Engineering Business
- TNO Science and Industry
- Tracerco Norge
- Trelleborg Offshore
- Triton Group Holdings
- Vector International Ltd.
- Versabar, Inc.
- VetcoGray
- Vryhof Anchors B.V.
- Wood Group

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DEEP OFFSHORE TECHNOLOGY International Conference & Exhibition
Stavanger, Norway 10 – 12 October 2007

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Last Name: _____

Title/Position: _____

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Email: _____

Confirmations will be sent by e-mail if a unique e-mail address is given.

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☐ 10 Oil/Gas company
☐ 20 Consulting Company
☐ 30 Contractor
☐ 40 Engineering/Construction
☐ 50 Financial
☐ 60 Service/Supply
☐ 65 Government/Library/Education
☐ 70 Other _____

2. Job Function:

☐ 02 Management (CEO, Pres.VP)
☐ 05 Engineering/Technical/Geoscience
☐ 06 Superintendent/Field Professional/Foreman
☐ 10 Purchasing/Consulting
☐ 12 Other _____

3. Areas of Interest/Involvement:

☐ 10 Exploration
☐ 05 Drilling
☐ 01 Production
☐ 29 Gas Processing
☐ 23 Pipeline/Transportation
☐ 19 Petrochemical
☐ 15 Refining
☐ 39 Financial
☐ 46 Other _____

4. Purchasing Role:

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Toll Free (US only): +1 888 299 8016
Pre-register on line before October 3, 2007. Register on site after October 3, 2007.

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Website:
deepoffshoretechnology.com

3
Mail: PennWell C&E
Registration (DOT)
P.O. Box 973081
Dallas, TX 75397-3081 USA

Conference Fees:

1. Full Conference Delegate (3-Day Registration)*

Includes:
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- Access to the Exhibition Hall, including both the Opening & Networking Receptions
- Coffee Breaks in Exhibition Hall
- Delegate Lunch on Wednesday, Thursday and Friday(Ticketed)
- Conference Proceedings

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*Your full-price registration fee includes a one-year paid subscription to Oil & Gas Journal (US$ 69.00 value).

Payment must be received prior to conference. If payment in not received by the conference date, the registration fee must be guaranteed on charge card until proof of payment is provided. Make check payable to Deep Offshore Technology 2007.

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For Information on corporate packages for 21 or more attendees contact Linda Adams
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DEEP OFFSHORE TECHNOLOGY International Conference & Exhibition
Stavanger, Norway 10 – 12 October 2007

Hotel Booking Form

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Contact person:		
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Post code/city:		**Country:**
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Rica Park Hotel	City center	NOK 1 550	NOK 1 750
Thon Hotel Maritim	City center	NOK 1 195	NOK 1 395
Victoria Hotel	City center	NOK 1 600	NOK 1 600
Skagen Brygge Hotell	City center	NOK 1 335	NOK 1 445

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International Conference & Exhibition

10 – 12 October 2007
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