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September 2015

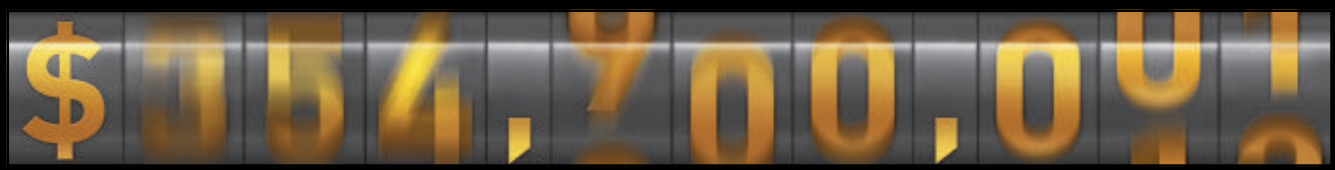
World Trends and Technology for Offshore Oil and Gas Operations

Reviewing deepwater trends

Mexico update
Composite risers

DeepStar mooring study

INSIDE:
Drilling fluids survey



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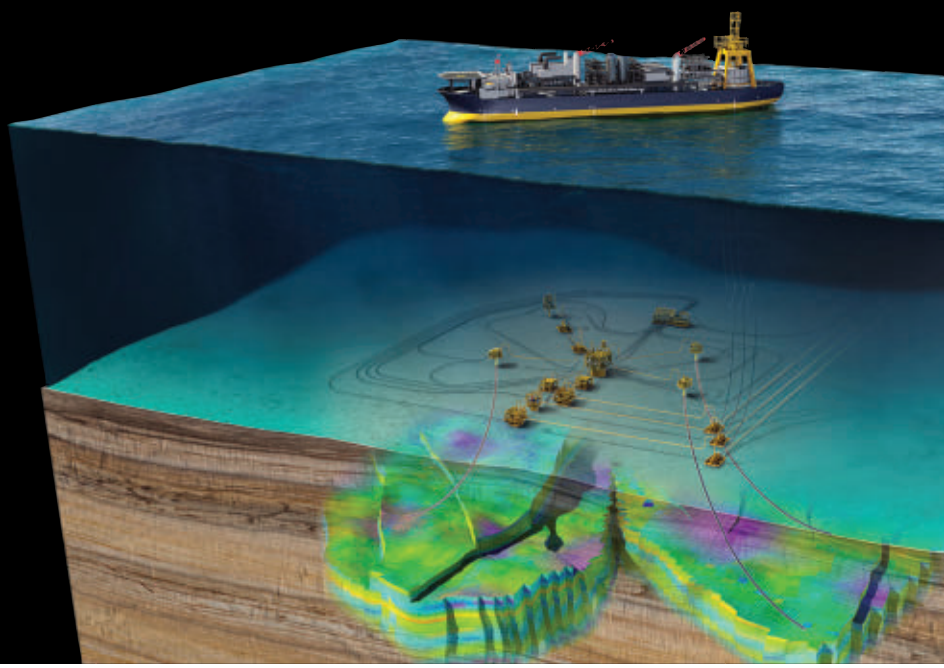

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Offshore (ISSN 0030-0608) is published 12 times a year, monthly by PennWell, 1421 S. Sheridan Road, Tulsa, OK 74112. Periodicals class postage paid at Tulsa, OK, and additional offices.

Subscription prices: US $123.00 per year, Canada/Mexico $ 145.00 per year, All other countries $202.00 per year (Airmail delivery: $283.00). Worldwide digital subscriptions: $123.00 per year. Single copy sales: US $12.00 per issue, Canada/Mexico $13.00 per issue, All other countries $17.00 per issue (Airmail delivery: $26.00). **Back issues are available upon request. POSTMASTER send form 3579 to Offshore, P.O. Box 3264, Northbrook, IL 60065-3264. To receive this magazine in digital format, go to www.offshoresubscribe.com.**

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September 2015

COVER: Projects in the Gulf of Mexico are getting bigger, which is one reason why analysts believe that the region will be one of the few bright spots in this year's deepwater activity. One example of the scale of projects being brought online in the Gulf is Anadarko Petroleum Corp.'s Lucius spar. Located in 7,100 ft (2,164 m) of water in the GoM's Keathley Canyon, the 605-ft (184-m) long spar has a 23,000-ton (20,865-metric ton) hull. Currently the company's newest and largest spar, the 80,000-b/d unit is part of its "design one, build two" philosophy. The second spar of the design set, Heidelberg, is expected to achieve first oil next year. See story on page 40. (Photo courtesy Anadarko Petroleum Corp.)

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Offshore ISSN-0030-0608
Printed in the U.S.A. GST No. 126813153

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New upcoming webcast

➤ Assessing Mexico's new offshore oil and gas opportunities

When Mexico's historic energy reform legislation became law on Dec. 21, 2013, it opened the country to foreign investment in its oil and gas sector for the first time in 75 years. A linchpin of President Enrique Peña Nieto's campaign, the far-reaching reform and subsequent secondary legislation enacted an entirely new legal framework for all of Mexico's oil and gas activities. Every sector is affected, from geological surveying, to storage and transportation, to exploration and production.

Register now to attend the September 30th webcast where Mayer Brown lawyers Dallas Parker and Gabriel Salinas will discuss the bidding process in Mexico.

http://www.offshore-mag.com/webcasts/offshore/2015/09/assessing-mexicos-new-offshore-oil-and-gas-exploration-opportunities.html

New on-demand webcast

➤ Anadarko's decommissioning of the first-ever cell spar in the Gulf of Mexico

The Red Hawk spar made history throughout its design life, commissioned and decommissioned as the first of its kind. Heralded as the first cell spar ever built, it remains the lone cell spar ever fabricated just slightly 10 years after its inception. Decommissioned in September 2014, it then earned distinction of being the deepest floating production unit to be retired in the Gulf of Mexico.

Ryan Kavanagh, a facilities engineer and project manager working in Anadarko Petroleum Corp.'s Deepwater Facilities group, discusses the decommissioning of the first-ever cell spar in the GoM.

http://www.offshore-mag.com/webcasts/offshore/2015/08/anadarkos-decommissioning-of-the-first-ever-cell-spar-in-the-gulf-of-mexico.html

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COMMENT

David Paganie • Houston

Rising oil production fuels bleak outlook

Despite the dramatic fall in oil prices, crude oil production, led by the US, Saudi Arabia, and Iraq, has been rising. This trend has been keeping supply well above the demand curve and further deteriorating the prospect of imminent oil price recovery.

Since the OPEC meeting last November, aggregate production from the aforementioned nations increased by an estimated 2 MMb/d – far more than global demand. Average US crude oil production was higher in the first half of this year compared to 4Q 2014, despite a 60% decline in the total US oil-directed rig count since October 2014. Meanwhile, at the time of this writing, OPEC was producing at a three-year high and up by 1.4 MMb/d since November 2014, led by record output from Iraq, Saudi Arabia, and UAE.

On the demand side, the IEA in its August Oil Market Report estimates that oil consumption in 2015 will grow by 1.6 MMb/d, up 0.2 MMb/d from its July report, which would be the fastest pace in five years. But, still not enough demand to soak up supply if it holds.

While Saudi Arabia defends market share with limited production downside, "a US production decline appears to be the most rapid avenue for erosion in the supply glut," IHS suggests in a recent Energy Insight note. However, the analytics firm contends that "prices have not yet fallen far enough or for long enough for an appreciable US supply adjustment to occur." IHS believes that prices would need to range in the low $40s or less for several months, to cut US production to about 9 MMb/d or lower.

Iranian factor

On July 14, the five permanent members of the United Nations Security Council, Germany, and Iran reached an agreement that could put additional Iranian oil production on a global market that is already oversupplied.

The relevant part of the Joint Comprehensive Plan of Action for the oil and gas industry is the potential lifting of Iranian oil sanctions. The main restriction on Iranian oil exports since 2012 – the European Union's embargo – will, under the agreement, remain in place until the International Atomic Energy Agency (IAEA) certifies that Iran is complying with the provisions of the agreement.

The Managing Director of the Iranian National Oil Co. has stated publicly that it could boost its production by 0.5 MMb/d immediately following the removal of sanctions and potentially by up to 1 MMb/d within six months. The EIA in its recent Short-Term Energy Outlook forecasts that, assuming sanction relief occurs in 2016, Iranian crude oil production will increase by 0.3 MMb/d from 2015 to 2016, with most of the increase coming in the second half of the year.

Meanwhile, Iran plans to unveil a new petroleum contract in December to attract international investors. The country reportedly has a backlog of more than 50 oil and gas projects that need at least $185 billion to go forward.

Project deferrals

As expected, the technically challenging and high-cost projects are proving vulnerable in this market. Over 45 major projects pre-FID had been deferred by mid-2015 due to the industry downturn, according to a recent blog by Angus Rodger, principal analyst of Wood Mackenzie.

Rodger estimates that 20 Bboe of reserves have been pushed back from onshore, shallow water and deepwater projects, totaling $200 billion in investments. His analysis finds that over 50% of the 20 Bboe of reserves were deferred from deepwater projects and about 30% from Canadian oil sands.

David Paganie

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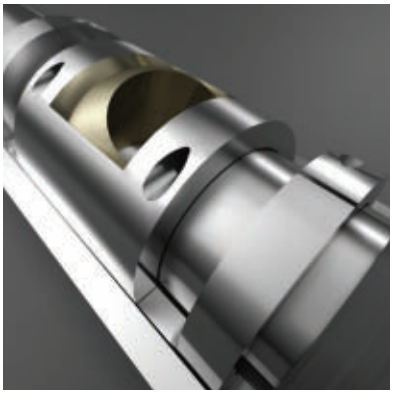

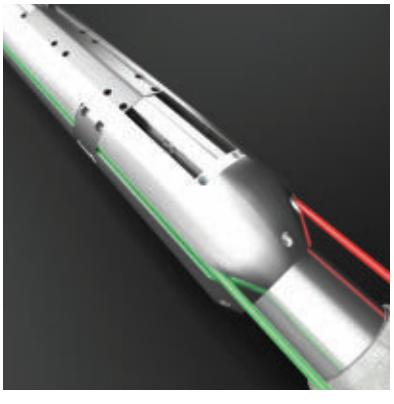

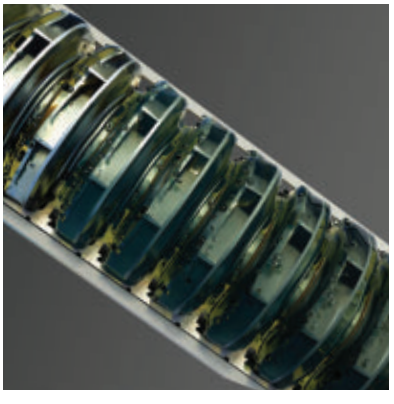

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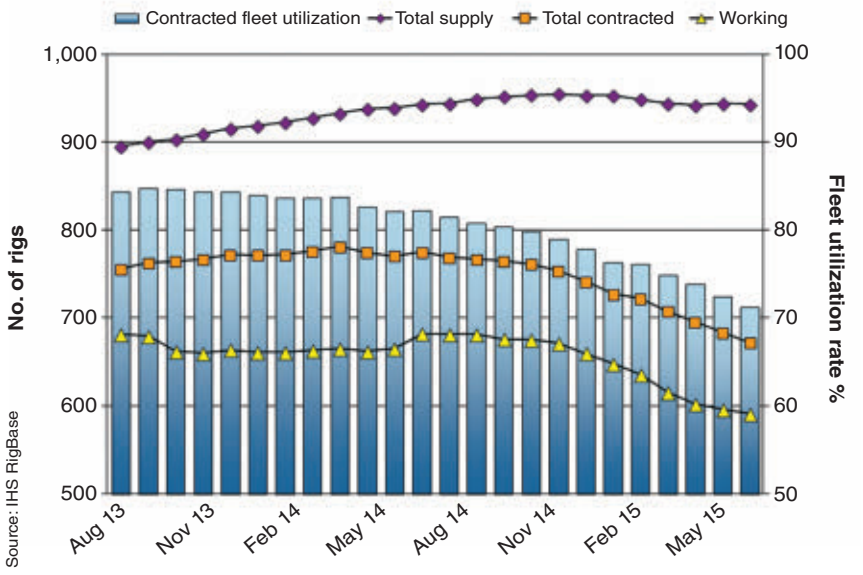
Year/Month	Minimum	Average	Maximum
Drillship			
2014 Aug	$151,000	$502,195	$735,000
2014 Sept	$151,000	$498,068	$735,000
2014 Oct	$151,000	$503,287	$735,000
2014 Nov	$151,000	$507,923	$735,000
2014 Dec	$151,000	$506,119	$735,000
2015 Jan	$151,000	$501,781	$735,000
2015 Feb	$151,000	$507,040	$735,000
2015 Mar	$151,000	$505,720	$735,000
2015 Apr	$97,000	$503,833	$735,000
2015 May	$97,000	$502,994	$708,000
2015 June	$97,000	$509,036	$670,000
2015 July	$97,000	$508,488	$670,000
Jackup			
2014 Aug	$43,300	$138,035	$389,000
2014 Sept	$43,300	$141,401	$389,000
2014 Oct	$43,300	$143,047	$389,000
2014 Nov	$43,300	$143,609	$389,000
2014 Dec	$43,300	$144,704	$389,000
2015 Jan	$51,405	$143,271	$389,000
2015 Feb	$51,405	$143,974	$389,000
2015 Mar	$51,405	$144,606	$389,000
2015 Apr	$38,000	$142,750	$389,000
2015 May	$51,405	$143,365	$389,000
2015 June	$51,405	$143,877	$414,000
2015 July	$53,000	$140,679	$414,000
Semi			
2014 Aug	$145,000	$392,877	$641,000
2014 Sept	$145,000	$387,635	$641,000
2014 Oct	$145,000	$389,381	$641,000
2014 Nov	$145,000	$391,838	$641,000
2014 Dec	$145,000	$389,993	$641,000
2015 Jan	$145,000	$397,075	$641,000
2015 Feb	$145,000	$397,727	$641,000
2015 Mar	$145,000	$403,899	$641,000
2015 Apr	$145,000	$402,197	$641,000
2015 May	$115,000	$401,943	$626,790
2015 June	$115,000	$404,804	$626,790
2015 July	$115,000	$402,159	$626,790

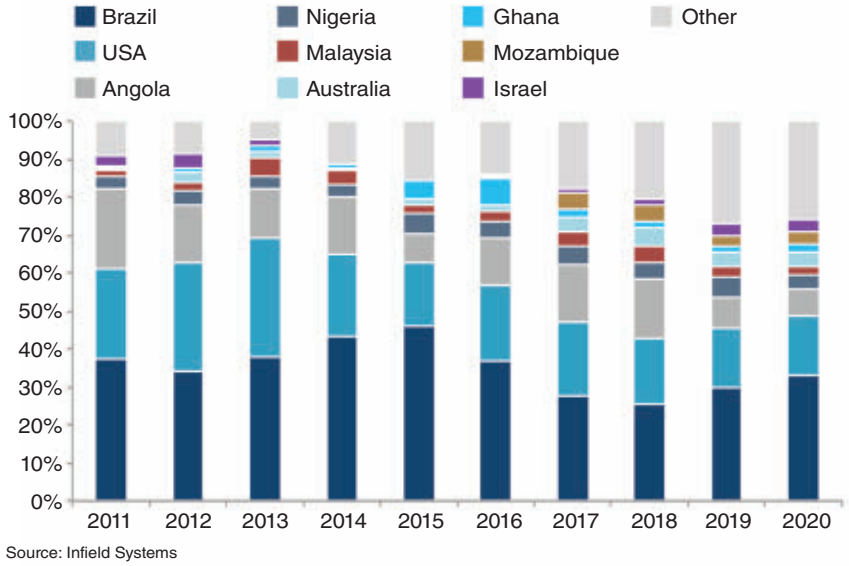
Source: Rigzone.com

Worldwide offshore rig count & utilization rate

August 2013 – July 2015



Global deepwater (>499 m) capex (%) 2011-2020 by country



Source: Infield Systems

As a result of the current market downturn, several planned capital intensive deepwater developments have witnessed delays in recent months. Capex spend in water depths of 500 m (1,640 ft) and greater is expected to decline throughout the remainder of 2015 and 2016. Infield Systems forecasts the largest decline in water depths of between 1,000 and 1,499 m (3,281 and 4,918 ft) as a result of a decrease in spend offshore Angola, Brazil, the Gulf of Mexico (GoM), and Malaysia. From 2017 onward, however, Infield Systems expects to see sustained growth in deepwater development expenditure; with prospects in ultra-deepwaters (>1,499 m) forecast to undergo the largest CAGR (20%) between 2016 and 2020. While Brazil, the GoM, and Angola are expected to comprise the largest share of deepwater capex demand during the next five years, emerging deepwater hubs, such as Mozambique and the Eastern Mediterranean are also expected to undergo significant investment over the remainder of the decade.

Offshore Mozambique, Infield Systems expects for a CAGR of 89% between 2016 and 2020 in deepwater expenditure demand. Prospects within the Rovuma offshore Areas 1 and 4 drive forecast demand, with Anadarko, Eni, and recent entrant CNPC expected to lead development. Anadarko is expected to hold the largest share of deepwater expenditure demand as a result of its development on the Prosperidade complex, while Eni/CNPC-operated prospects within Area 4, such as Coral, Mamba North, and Mamba South fields are also expected to require significant investment.

The Eastern Mediterranean, driven by developments within the Levant basin, is expected to see strong growth over the next five years. Offshore Israel, Infield Systems expects the Leviathan development to drive deepwater expenditure demand over the remainder of the decade, accounting for a 90% share of capex demand. Elsewhere within the Eastern Mediterranean, Infield Systems expects for Noble's deepwater Aphrodite field to require significant spend toward the end of the forecast period.

– Catarina Podevyn, Published Content Analyst, Infield Systems Ltd.

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Jeremy Beckman • London

FLNG set for second wave of investments

Worldwide expenditure on floating LNG could exceed $58.3 billion over the next seven years, according to a report from analyst Douglas-Westwood (DW). Compared with onshore LNG, FLNG facilities are more secure, can be developed more quickly, and are potentially a lower-cost alternative for stranded offshore gas fields, the analyst claims. Investments will likely dip in 2018 as the first installations are completed, recovering later in the decade as a second wave of projects gets under way. Yet-to-be sanctioned projects will target stranded gas offshore Australasia, the Eastern Mediterranean, East and West Africa, DW adds.

North America

The Canada-Newfoundland and Labrador Offshore Petroleum Board has conditionally approved Husky Energy's amended development plan for the White Rose extension project. Husky has not taken a final investment decision, although the board has approved a scheme based on a fixed wellhead platform. White Rose is 300 km (186 mi) offshore Newfoundland and Labrador.

South America

Anadarko has proven gas with its first well in the deepwater Grand Fuerte block in the Caribbean Sea, 53 km (33 mi) offshore Colombia. The well, drilled by the *Bolette Dolphin* drillship in 1,584 m (5,195 ft) of water, intersected 130-230 net ft (39.6-70 m) of pay in the upper objective, confirming a working petroleum system. The rig was due to transfer 161 km (100 mi) north to drill a second well for Anadarko and partner Ecopetrol on the Calasu prospect.

• • •

Petrobras has started production from the Iracema Norte area of the Lula field in the presalt Santos basin offshore Brazil. The first well online at the FPSO *Cidade de Itaguaí* has potential to flow 32,000 b/d. Eventually eight producers and nine injectors will be drilled, with peak oil production of 150,000 b/d in early 2017. The location is 240 km (149 mi) offshore in 2,220 m (7,283 ft) of water.

According to BG Group, the Petrobras-led BM-S-11 consortium has submitted initial development plans for the Atapú, Sururu and Berbigão fields, all within the wider Iara area in the Santos basin. The current proposal is for two lookalike FPSOs, with the first, serving Atapú, due to start operating in 2018. The other will be on Berbigão, tying in production from Sururu via subsea wells, although plans could change following operational experience.

West Africa

Xplorer has signed a memorandum of understanding to acquire a 36.75% interest from Teredo International in the shallow-water Boujdour permit offshore Morocco. The concession could hold oil and gas resources of up to 463 MMboe.

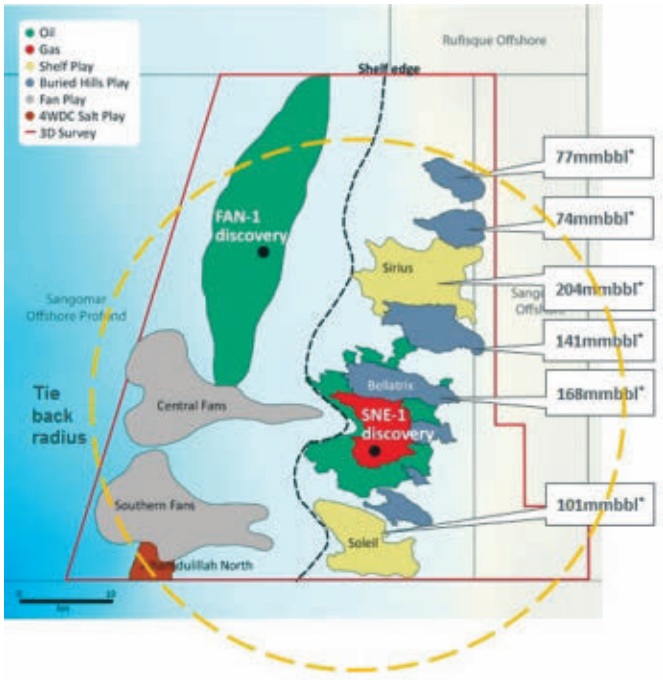
London-based Genel Energy, however, has opted to withdraw from the offshore Juby Maritime license following results from an appraisal well last year on an old heavy-oil discovery. Genel is also working with Morocco's government to determine the best way forward for its Sidi Moussa offshore license, where last year's SM-1 exploration well recovered oil to surface.

• • •

The partners in Chinguetti, Mauritania's first producing offshore oil field, are working on a decommissioning plan as the oil price renders production sub-commercial. Recently the government approved Tullow Oil's assignment of a 13.5% stake in the C-10 production-sharing contract surrounding Chinguetti to UK independent Sterling Energy. Water depths range from 50-2,400 m (164-7,874 ft).

• • •

Australian independent FAR says the Cairn Energy-led consortium has contracted the drillship *Ocean Rig Athena* for its next phase



Potential drilling targets offshore Senegal for the Cairn-led consortium. (Map courtesy FAR)

of exploratory drilling offshore Senegal, designed to build on last year's two deepwater oil finds. The first two wells will appraise the SNE discovery to establish its size and commerciality. The third well will target a new prospect – Bellatrix, Soleil, or Sirius – in an attempt to prove further resources that could be tied back to a production hub on SNE.

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The World Bank has approved $700 million in guarantees for the Sankofa gas project, which will ease Ghana's energy shortage by providing new sources of gas for power generation. This will come from five fields Eni and Vitol plan to develop in the Offshore Cape Three Points block, 60 km (37 mi) offshore, via subsea production systems tied back to an FPSO. The gas will be exported through a subsea pipeline to reception facilities on Ghana's western coast.

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Total has started production from the Phase 1A development of the deepwater Dalia field in block 17, 135 km (84 mi) offshore Angola. This is designed to extract a further 51 MMbbl of reserves and sustain production through the FPSO, which came onstream in 2006, at around 200,000 b/d. The project involved debottlenecking of onboard treatment facilities and drilling seven infill wells.

On block 18, BP has brought online Phase III of the Greater Plutonio project. Here too the purpose is to sustain production levels through the FPSO, in this case via four new producers and two new water injector wells.

Mediterranean Sea

PA Resources and state oil company ETAP have submitted an updated plan for the 147-MMboe Zarat field offshore Tunisia, said to be the country's largest undeveloped offshore resource with similar geology to nearby producing fields such as Ashtart and Hasdrubal. The partners propose a phased development, with fixed facilities processing eventually up to 40,000 b/d of oil and 200 MMcf/d of gas from eight wells. If approved, the new complex could also serve as a hub for production from other stranded fields in the eastern Gulf of Gabes.

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BP has contracted Subsea 7 to engineer and install subsea infrastructure for the Libra and Taurus fields under the first phase of the Nile Delta project offshore Alexandria. Water depths are around 800 m (2,624 ft). The workscope includes laying 75 km (46.6 mi) of umbilicals and 100 km (62 mi) of subsea pipeline. Petrojet Madia near Alexandria will fabricate the other subsea structures and spools. Offshore installations for the $500-million contract should start during the second half of next year.

In Egypt's offshore Nile Delta, Eni has discovered gas with a well on the Nooros prospect on the Abu Madi West license, while the Ministry of Petroleum has awarded a new exploration block in the southern Gulf of Suez to Pacific Oil and Gulf Hibiscus. The South East Ras El Ush concession (block 2) covers 68 sq km (26 sq mi) in waters up to 75 m (246 ft) deep. It contains the West Ashrafi discovery, which the partners may seek to develop via a tie-in to nearby onshore infrastructure.

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Cypriot state utility DEFA has been given more time to review a proposal from the Leviathan field partnership offshore Israel to export gas to Cyprus via new subsea pipelines. The period of validity now runs to Oct. 31.

Noble Energy operates Leviathan and Aphrodite, Cyprus' sole deepwater gas discovery to date. The company says pre-front-end engineering and design has started on a potential scheme to take production from Aphrodite directly to customers in Egypt.

East Africa

ExxonMobil and Rosneft subsidiary RN-Exploration have filed joint bids for contract areas in the Angoche basin and Zambezi Delta under Mozambique's fifth license round. If any awards result, ExxonMobil would operate.

Global Petroleum has opted to withdraw its application to extend the term of its offshore Juan de Nova permit in the Mozambique Channel. The company first applied for an extension in August 2013, but the French authorities have not responded.

India

ONGC plans to invest more than $8.8 billion in developing reserves in the Krishna-Godavari basin offshore eastern India. The company has earmarked 12 discoveries in the KG-D5 license and a gas find in adjacent block G-4 in the Bay of Bengal, to be developed via a fixed platform and FPSO with subsea pipelines.

Asia/Pacific

SBM Offshore has secured a three-year extension to its contract to operate the FSO *Yetagun*. The vessel serves the Petronas-operated Yetagun gas/condensate field in the Gulf of Martaban offshore Myanmar, currently undergoing brownfield engineering works in order to prolong its productive life.

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The heads of PetroVietnam and Murphy Oil have signed a memorandum of understanding to collaborate. Murphy is interested in participating in development of the block B gas project in the offshore Malay – Tho Chu basin and various blocks in the offshore Cuu Long basin. In return, PetroVietnam could get access to Murphy projects in the Gulf of Mexico.

PanPacific Petroleum says operator Repsol (Talisman) should finalize plans to develop the CRD oil and gas discovery offshore Vietnam by the end of this year. The preferred option remains a tension leg wellhead platform linked to an FPSO, producing 30,000 b/d from six wells at start-up, targeted for late-2018.

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CNOOC has started production from the Luda 10-1 comprehensive adjustment project in the Liadong Bay in China's Bohai region. The Luda 10-1 oil field is in 30 m (98 ft) of water – development involved adding a new wellhead platform. Production should build to a peak of 6,000 b/d next year.

Primeline Energy has a letter of intent with China Oilfield Service Co. Ltd. to drill two exploration wells in block 33/07 in the East China Sea. Estimated cost is $20 million, excluding testing. Primeline and partner CNOOC aim to prove further gas volumes to tie into infrastructure serving the nearby offshore gas field LS36-1.

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Petronas has produced first oil from the Tembikai field offshore Peninsular Malaysia, under the Tembikai-Chenang Cluster small field risk service contract. Eventually three production wells will supply 2,000 b/d through the central processing platform, a lightweight Seahorse design, linked to an FSO via a flexible subsea pipeline. Water depth is 70 m (230 ft).

In the deepwater Sabah Delta basin offshore Sabah, Murphy has scored its eight successive gas find on block 10. The Permai prospect is one of various under review for tie-in to the Rotan field FLNG project.

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Japan's government has commissioned INPEX to drill an exploratory well at a location offshore Yamaguchi and Shimane prefectures. Here the geophysical vessel *Shigen* conducted a geophysical survey in 2011 as part of Japan's Domestic Oil and Natural Gas Exploration project, and two years later INPEX acquired 3D data in the same area. Drilling should start next May, in a water depth of 210 m (689 ft).

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Eni has upgraded reserves at its deep offshore Merakes gas discovery in Indonesia's East Sepinngan block following further technical studies. It now plans to advance an appraisal campaign with a view to a fasttrack tie-in to infrastructure serving the company's nearby Jangkrik field development.

Australia

Subsea installations have started for Phase 1 of Woodside Petroleum's Xena gas field development offshore Western Australia. The gas started flowing to the onshore Pluto LNG plant this past June.

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Octanex plans to seek a retention lease over the WA-407 permit containing the Ascalon gas discovery, 465 km (289 mi) west of Darwin in a water depth below 100 m (328 ft). The company plans further engineering studies to determine the field's commerciality.

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AWE is considering accelerating development studies for the 17-MMboe Trefoil field in the T/18P permit in the Bass Strait offshore Victoria. Trefoil could be tied into infrastructure serving the nearby Yolla field, where operator Origin Energy recently downgraded its estimate of remaining gas reserves. Yolla produces from a wellhead platform 140 km (87 mi) offshore Kilcunda – the gas is exported through a pipeline to a processing complex onshore at Lang Lang.

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Cooper Energy has upgraded the resource potential at the Manta field in the Gippsland basin 57 km (35 mi) offshore southeast Australia. It claims development of the field's gas is technically feasible via a two-well subsea development, with the wellstream sent directly through a subsea pipeline system to the onshore Orbost gas plant. The previous consortium produced oil from Manta over a four-year period as part of the Basker-Manta-Gummy project.

Jeremy Beckman • London

UK development revival lifts production

Provisional data from Britain's Department of Energy and Climate Change (DECC) suggests UK offshore production is increasing for the first time in 15 years. Output across the shelf for the first half of 2015 was up by 2.5% compared with the same period in 2014.

Industry association Oil & Gas UK said the improvement was partly due to growing volumes from the Nexen-operated Golden Eagle project in the UK central North Sea, which started up last fall. Improved performance from other fields may be another factor, reflecting the industry's heavy investment in recent years in prolonging the integrity of UK production facilities.

Cygnus compression module leaving Heerema Hartlepool. (Photo courtesy Heerema Fabrication Group)

Output should continue to rise as more new projects come onstream in the next few months, including Premier Oil's Solan and Total's Laggan/Tormore projects near the Shetland Islands; EnQuest's Alma/Galia in the UK central North Sea; and GDF Suez E&P UK's Cygnus in the southern gas basin.

Here Seaway Heavy Lifting's crane vessel *Oleg Strashnov* recently installed the process unit (PU) platform topsides, in the process establishing a new lift record for the contractor with a hook load of 4,700 metric tons (5,181 tons). Earlier, the Heerema Hartlepool yard in northeast England delivered the compression module for the Cygnus Alpha platform, the last of the main structures the yard has built for the four-platform complex. At Methil on Scotland's east coast, Burntisland Fabrications completed its fourth and final jacket for the field, for the Bravo platform.

Larger-scale projects should come onstream in the Shetlands area over the next two years, namely BP's Clair Phase 2 (Clair Ridge) and Quad 204 redevelopment, and Statoil's Mariner. The 22,400-ton jacket for the Mariner platform – the biggest jacket ever built by Dragados Offshore at its yard in Cadiz, southwest Spain – was due to be launched and installed at the field location last month.

Latest UK license round completed

Britain's new Oil & Gas Authority has issued 41 new licenses following additional environmental assessment and consultations under the 28th Offshore Licensing Round. This lifts the total number of UK offshore licenses awarded since the first batch late last year to 175, spanning 353 blocks.

The latest awards include frontier acreage in the Rockall Trough off western Scotland, where the government has pledged support for 2D seismic acquisition, and the St George's Channel basin separating the southwest UK and southeast Ireland. Licensees range from experienced operators to relative newcomers, said Oil & Gas UK operations director Oonagh Werngren. While welcoming the response to the round, she expressed concern that the latest awards carried commitments to only one firm well and five new 3D seismic campaigns, with most of the licenses conferred on the basis of reprocessing or securing old 2D and 3D data.

Among the frontier award winners were Hurricane Energy, which picked up blocks 204/30b and 205/26d close to its basement Lancaster oil discovery in the West of Shetland region. The blocks include the potentially analogous Warwick structure and a possible extension of the Lincoln prospect. Hurricane has been working with Schlumberger on a full-field simulation model of Lancaster's reservoir, based partly on analysis of last year's 1-km (0.6-mi) horizontal appraisal well. They have concluded that a phased development could be commercial, initially via an early production system.

The Faroe Islands government intends to stage the country's fourth Exploration Round in 2017. Despite the modest results from the nine offshore exploration wells drilled over the past 15 years and the recent license relinquishments, the government maintains the subsoil around the islands is oil-prone and underexplored. The Faroes' current Open Door license application procedure will remain closed until after the new round is launched.

Survey to clarify western Ireland potential

Searcher Seismic and Russian geophysical contractor MAGE have completed the Echidna Regional Broadband 2D seismic survey over the Porcupine and Slyne basins and the Goban Spur offshore western Ireland. The 9,100-km (5,654-mi) program is said to be the first authentically regional, long-offset well tie survey over the Irish continental shelf to employ modern processing and acquisition techniques. Fasttrack prestack time migration data should be available for the planned opening of Ireland's 2015 Atlantic Margin bid round this month.

Jan Gunnar Opsal, Searcher's Norway country manager, said the survey ties in 30 exploratory and appraisal wells, around 80% of the total drilled in the area. "The rift systems associated with these basins are among the most interesting exploration targets in the North Atlantic," he added.

Statoil reports second find in King Lear area

Statoil and Total have discovered gas and condensate in the high-pressure/high-temperature Julius prospect close to the undeveloped King Lear field in the southern Norwegian North Sea. Recoverable volumes appear to be in the 15-75 MMboe range, confirming Statoil's previous estimate for the King Lear area of 70-200 MMboe.

In the northern Norwegian North Sea, Statoil has started up its latest subsea add-on project, Gullfaks South, designed to produce a further 65 MMboe from the Gullfaks area and extend the life of the Gullfaks A platform beyond 2030. The company sanctioned the NOK 9-billion ($1.09-billion) program three years ago. Statoil says the subsea scope was more complex than some of its previous tieback projects, with a total of 22 subsea tie-ins. Development calls for two subsea templates, four producer wells and two gas injectors with a dedicated gas injection pipeline, along with umbilicals and power cables for pipeline heating.

Lundin Petroleum continues exploration around the Edvard Grieg field in the central Norwegian North Sea, where production should begin this fall. The company's latest well encountered a 66-m (216-ft) oil column at the field's southeastern edge. This area and the Luno II discovery could both be tied in at some point to the Edvard Grieg production platform.

Hibiscus, Ping clinch deal for Anasuria

Shell and ExxonMobil have agreed to terms for their second major UK North Sea asset sale this year. Hibiscus Petroleum and Ping Petroleum will jointly acquire the producing Anasuria cluster of oil and gas fields in the UK central North Sea, subject to the usual consents. The package includes the *Anasuria* FPSO and associated processing infrastructure, with potential for future tie-ins of nearby accumulations; the Guillemot A, Teal and Teal South fields; and a 38.65% interest in the Cook field. Hibiscus said the transaction was facilitated by the UK government's measures to support smaller independents looking to invest in the UK continental shelf.

In June, Shell/ExxonMobil completed the sale of the Sean gas field and associated platform in the UK southern North Sea to Oranje-Nassau Energie.

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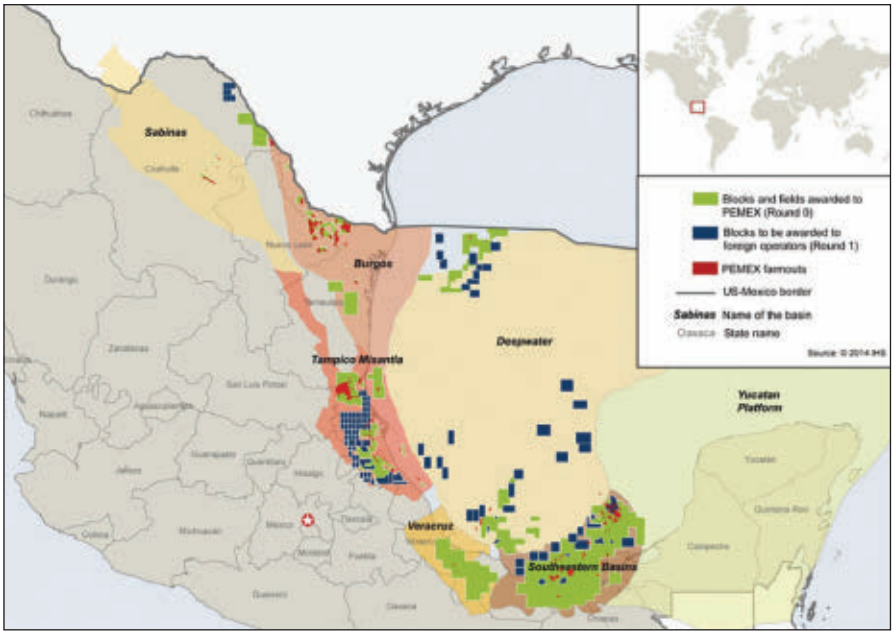

Mexican government officials say they will postpone auctions for deepwater oil exploration and production contracts, and adjust the terms of upcoming tenders. (Courtesy IHS)

Mexico revises rules for second phase of Round One auction

Mexico's oil regulator has unveiled more attractive rules for the second phase of the country's Round One oil auction, according to a report in the Latin American Herald Tribune. The changes include lowering corporate guarantees and making other changes after a disappointing first phase.

In late July, Mexican government officials indicated that they would postpone auctions for deepwater oil exploration and production contracts, and adjust the terms of upcoming tenders.

In the second phase, scheduled for Sept. 30, bidders will be competing for five shallow-water areas off the coasts of the Gulf coast states of Tabasco and Campeche with reserves estimated at 671 MMboe.

Under the new rules, a company that is the operator of a consortium bidding for one production-sharing contract may now also bid individually for a separate contract.

In another change, the commission also said a $2.5-million bid security guarantee will cover all contracts a bidder is awarded and will not need to be provided for each separate block.

That guarantee, as well as a performance guarantee that has been set at 50% of the minimum work program, may be reduced annually in proportion to the winning bidder's progress in fulfilling its contractual obligations, said Martin Alvarez, the CNH's bids coordinator.

In another change, the CNH added a required insurance policy to each contract to cover up to $1 billion in damage from spills or accidents.

For each block, winning bidders also must hire a service provider that specializes in well control.

The changes come after phase one of the Round One oil auction, the first held since Mexico opened its oil industry to private and foreign investment, ended in disappointment.

The government had expected that between 30-40% of the 14 shallow-water exploration blocks on offer in that July auction would be awarded, but only two were acquired, both by a consortium made up of Mexico's Sierra Oil & Gas, Houston-based Talos Energy, and Britain's Premier Oil.

Mexican state-owned oil company PEMEX, which obtained 83% of the country's proven and probable reserves and 21% of its potential resources in a so-called "Zero Round" of non-competitive bidding last year, did not participate in the initial phase of Round One.

Mexico's government is looking to the energy overhaul to attract tens of billions of dollars in investment and reverse a roughly 30% decline in Mexico's oil output, which peaked at 3.38 MMb/d in 2004 and currently stands at roughly 2.3 MMb/d.

Mexico is starting small with its offer of shallow-water fields and onshore blocks this year and saving the potentially bigger deepwater fields in the Gulf of Mexico for later tenders.

US GoM Lease Sale 246 yields $22.7 million in high bids

In mid-August, the US Department of the Interior's Bureau of Ocean Energy Management (BOEM) held an oil and gas lease sale for the Western GoM that drew $22,675,212 in high bids for tracts on the US outer continental shelf offshore Texas.

A total of 5 offshore energy companies submitted 33 bids on 33 tracts, covering about 190,080 acres.

"The Gulf remains a critical component of our nation's energy portfolio and holds important energy resources that spur economic opportunities for Gulf producing states, creating jobs and home-grown energy and reducing our dependence on foreign oil," said BOEM Director Abigail Ross Hopper. "While this sale reflects today's market conditions and industry's current development strategy, it underscores a steady, continued interest in developing deepwater federal offshore oil and gas resources."

Lease Sale 246 builds on the first seven sales held under the Obama Administration's Outer Continental Shelf Oil and Gas Leasing Program for 2012-2017 (Five-Year Program) that offered more than 60 million acres for development, garnered $2.9 billion in bid revenues, and awarded 1,038 leases. The Five-Year Program makes available all offshore areas with the highest resource potential and includes 75% of the nation's undiscovered, technically recoverable offshore oil and gas resources.

"As one of the most productive basins in the world, the Gulf of Mexico continues to be the keystone of the nation's offshore oil and gas resources," Hopper said.

"The continuing drop in oil prices and low natural gas prices obviously affect industry's short-term investment decisions, but the Gulf's long-term value to the nation remains high and the president's energy strategy continues to offer millions of offshore acres for development while protecting the human, marine and coastal environments, and ensuring a fair return to the American people."

Lease Sale 246 offered 4,083 unleased blocks, covering about 21.9 million acres, located from nine to 250 nautical miles offshore in water depths ranging from 16 to more than 10,975 ft (5 to 3,340 m).

The lease terms include a range of incentives to encourage diligent development and ensure a fair return to taxpayers. The leases would also allow a lessee to earn a longer lease term for spudding a well in deeper water or by drilling to a minimum target depth.

Each bid will go through a strict evaluation process within BOEM to ensure the public receives fair market value before a lease is awarded.

The top bids in the lease sale included those from Ecopetrol America Inc., BP Exploration & Production Inc., Anadarko US Offshore Corp., BHP Billiton Petroleum (Deepwater) Inc., and Peregrine Oil & Gas II, LLC.

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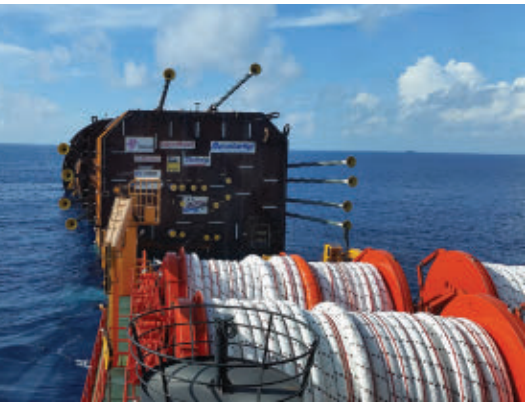

Pictured is the Heidelberg spar as it is being prepared for mooring work. (Photo courtesy InterMoor)

InterMoor completes support work on Heidelberg spar

InterMoor Inc. provided Anadarko Petroleum Corp. with hook-up services for its Heidelberg truss spar in the deepwater Gulf of Mexico after stepping in at short notice for another contractor. The Houston-based company said it adapted its procedures in a short amount of time to ensure the new production facility was safely secured in case of a storm.

The company hooked up the 80,000-b/d spar to three mooring lines in Green Canyon block 860 offshore Louisiana, at a water depth of 5,300 ft (1,600 m) to ensure the hull was storm safe. The project's original contractor then resumed the job to complete the remaining six mooring lines along with the completion of the spar installation as planned.

For the Heidelberg job, InterMoor mobilized five vessels from Fourchon, Louisiana, and provided crews for each. The company initiated the engineering work in March 2015. Offshore work began in early June, and InterMoor completed its part of the hook-up over a two- to three-week period that ended in July. This involved more than 40 InterMoor staff on two tugs and three anchor-handling vessels. The *Kirt Chouest* and the *Dino Chouest* were the main AHTVs and a third acted as a support vessel between them and the platform. These vessels, as well as McDermott's *DB 50*, maintained station-keeping for the spar and completed the hook-up operations to get the spar storm safe.

Todd Veselis, general manager of Permanent Moorings, InterMoor, told *Offshore* that it took less than two months to adapt its procedures to accommodate for this unique request because of its work with floating production systems (FPS) in the GoM.

He specifically named InterMoor's work on ATP Oil & Gas' Mirage field, which is part of the Telemark hub, and LLOG's *Delta House* semisubmersible FPS.

"We drew heavily from previous experience with similar techniques and installation, which was a big part as to how we turned this around so quickly," Veselis told *Offshore*. He continued by noting that while every job differed, there were enough similarities within these projects that the company had good starting points in developing Heidelberg's mooring and hook-up techniques.

InterMoor's vessel expertise also allowed it to mobilize quickly. The company previously installed mooring components using similar AHTVs. A spokesperson for InterMoor confirmed to *Offshore* that InterMoor set a company record while completing the Heidelberg job: With a chain of 157 mm and a rope of 10-in., these are the largest mooring components the company has installed from an AHTV.

Previously, InterMoor fabricated some suction piles for the Heidelberg project in February 2015 and provided representatives during the installation of the Lucius spar, which is identical to the Heidelberg, in 2014. For additional information on the Heidelberg and Lucius spars, see page 40.

Subsea service providers expand offerings

According to a recent report issued by Douglas-Westwood (DW), the subsea sector is moving away from using multiple vendors toward selecting one provider that offers multiple services.

The subsea sector is highly consolidated, with just five players servicing the $12 billion annual requirements of the global E&P community, the firm explained. FMC Technologies and OneSubsea account for approximately two-thirds of the market, yet have gone on to form strategic partnerships to reshape and redefine the commercial landscape. DW said that such alliances have become increasingly critical as projects have grown in scale and complexity.

In light of the continuing trend of companies forming subsea joint ventures and alliances to broaden the range of their services and expertise, the analyst firm continued by offering a few examples, pointing first to the 2013 joint venture between Cameron and Schlumberger to form OneSubsea and noting that "it was a deliberate attempt to unite the former's subsea skill with the latter's downhole and processing expertise."

Another example given was the recent partnership between FMC Technologies and Technip to form Forsys Subsea, which combines subsea production, processing and installation capabilities, with the aim of minimizing both supply chain and technological interfaces for the end user.

Ultimately, the report notes, E&P companies have been gradually moving from a "pick and choose" approach, to procuring systems from a single vendor. DW data suggests that 15 years ago, nearly a fifth of subsea wells installed had different manufacturers for the trees and controls, while in 2015, it is expected that more than 95% of subsea trees installed will have wellheads and controls from the same manufacturer. This trend is set to develop further with an appetite for standardization of subsea equipment that has been driven by cost pressures, lower oil prices, and the subsequent need to deliver projects on-budget, on-time.

Chevron joins Viper Subsea JIP

Chevron has joined Viper Subsea's joint industry project (JIP) to develop its subsea integrity monitoring system known as V-IR. The V-IR system is used to identify and locate faults in remote subsea electrical distribution systems. The project, which began in October 2013, has attracted Shell, BP, and Total, and the additional sponsorship by Chevron will allow for enhanced functionality and an extended test period.

Viper Subsea will conduct all research and development for the V-IR system, while the JIP partners will contribute funding and ensure the products are optimized for field use. The JIP has been facilitated by the Industry Technology Facilitator.

"The additional design work will focus on developing the SIIS interface to allow the technology to be easily integrated into an Active Electrical Distribution Unit. We are delighted to welcome Chevron to the project," said Neil Douglas, managing director of Viper Subsea.

The company anticipates the new V-IR system to be ready for a field-trial later this year.

Previous to this announcement, Chevron linked up with OneSubsea to form a JIP to develop subsea systems technology for 20,000-psi applications.

Subsea connections in place on *Goliat*

First Subsea has installed bend stiffener connections (BSC) for gas lift and production risers, power cables, and umbilicals for the *Goliat* FPSO. The Eni Norge-operated Goliat field is the northernmost offshore oil field in the world.

The *Goliat* FPSO currently features 11 Type II BSCs, with a further 10 receptacle I-tubes pre-installed within the base of the vessel. These will enable more tiebacks to be added as field production increases.

Eni Norge says that at 107 m (351 ft) in diameter, the Sevan Marine-designed *Goliat* platform is the largest cylindrical FPSO facility ever built. It moved into the final commissioning phase in late June. Eventually, 22 wells will be connected to the platform, which has a capacity of 100,000 b/d.

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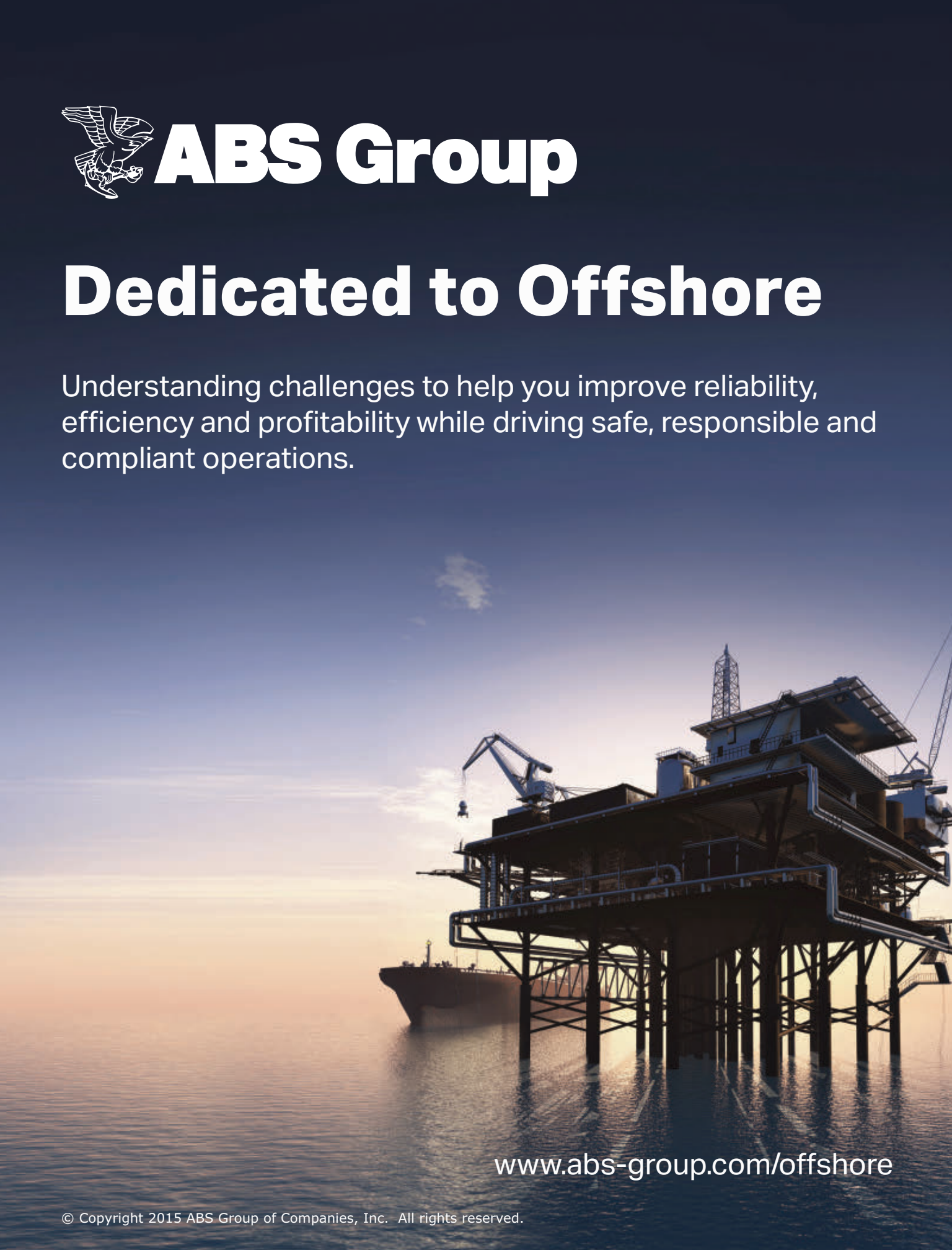

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Floating production market slows further in 2Q

In its recently published 3Q 2015 Floating Production Systems Report, Energy Maritime Associates (EMA), analyzed the latest market activity for all types of floating production systems: FPSO, FLNG, FSRU, TLP, spar, semi, FSO, and MOPU. The study found that three units were awarded, worth more than $2 billion: one production semi and two FSRUs; nine units were delivered: two FPSOs, one FSRU, one spar, four FSOs, and two MOPUs; and four units were decommissioned: two FSOs were scrapped and two small FPSOs for well testing are now available.

EMA also noted that Petrobras released its long-awaited 2015-19 business plan, which drastically reassessed its future production, the number of new production units required, as well as the schedule for units currently on order. The latest plan revised the number of new floating production units from 14 to five. These leased units, which are being provided by Modec, SBM, and Teekay are currently on schedule. The owned units, which were to be built by Brazilian contractors, have encountered further delays and some work has been re-contracted to Chinese yards. Delivery of these units is now scheduled for 2017 and beyond. Additionally, planned divestment of $57.7 billion by 2018 should provide opportunities for new operators in Brazil and reinvigorate demand for floating production systems.

According to EMA's Managing Director David Boggs, "As anticipated, there were fewer awards in the first half of 2015. The second half of the year is expected to be worse, as project sanctions continue to be delayed due to cost pressures. However, developments will move through the planning pipeline and companies are waiting for the right time to lock-in attractive pricing. We believe more projects will achieve FID toward the end of the 2015 and into 2016."

Topaz Middle East vessel demand holds steady

Topaz Energy and Marine remains positive over prospects for offshore support vessels in the Middle East and Caspian regions.

The contractor's vessel take-up in the Caspian rose to 98% in the first half of this year, up 5% from 1H 2014, while its overall fleet utilization remained around 85%.

Topaz continues to see high levels of activity offshore Qatar and Saudia Arabia and is confident of securing additional long-term contracts in this area, according to CEO René Kofod-Olsen.

This summer the company also established a division in Angola, received the necessary operating licenses, appointed a country manager and rented office space for three years, allowing it to progress from spot rate contracts to securing medium- to long-term contracts.

"Africa is a long-term strategic investment for Topaz," he added, "as the offshore market is forecast to grow and clients will increasingly require our services."

FLNG capex to reach $58.3 billion by 2021

Capex for FLNG vessels is estimated by Douglas-Westwood to reach $35.5 billion during 2015-2021. FSRU capex is forecast at $22.8 billion for the same time period. That makes the overall FLNG spending $58.3 billion for the period as predicted in World FLNG Market Forecast 2015-2021.

The delivery of Petronas' *PFLNG 1*, also known as *PFLNG SATU*, will put the world's first FLNG vessel into operation by the end of 2016.

This will be followed by Shell's Prelude FLNG vessel, a significantly larger project and one that is likely to shape future FLNG developments. Construction of the 488-m (1,601-ft) long facility started in 2012 at Samsung in Korea, and is expected to start up by 2017.

Following these projects is a second wave of new projects that are yet to be sanctioned, but are expected to drive a growth in expenditure from 2019 onwards. This includes major projects in frontier regions such as East Africa.

DW anticipates more floating regasification units are to be sanctioned, with Asia and Latin America being the dominant regions. Upcoming projects are visible in Indonesia, China, Pakistan, India, Vietnam, Bangladesh, and Sri Lanka, mostly led by national oil companies. Latin America will see deployments of floating regassification units in Chile and Puerto Rico.

The *MV Legionnaire* was launched at Damen Shipyards Galati, Romania. (Photo courtesy Damen Shipyards)

Damen releases the second of two Newfoundland and Labrador ferries

The second of two 80-m (262-ft) ice-class Ro-Pax ferries – the *MV Legionnaire* – was launched at Damen Shipyards Galati, Romania. The naming was performed by Lori Anne Companion, Deputy Minister at the Department of Transportation and Works of the Government of Newfoundland and Labrador, Canada.

The *MV Legionnaire* is sister ship to the *MV Veteran*, launched earlier this year at the Romanian yard. Both vessels are part of a large vessel replacement program being undertaken by the Provincial government. At 81 m (266 ft) in length and with a beam of 17 m (56 ft), the vessel will carry up to 200 passengers and 60 cars at a cruising speed of 14 knots. *MV Legionnaire* will operate on the short-haul route from Portugal Cove to Bell Island, the busiest route of the province.

Grampian Fortress is latest vessel to join Craig Group's fleet

Craig Group has launched its first F-Class vessel, the *Grampian Fortress*. The IMT 958 multi-role emergency response and rescue vessel (ERRV) was christened in the Balenciaga Shipyard in Northern Spain.

It is the first of two F-class vessels in the group's £110-million investment, which has already seen eight vessels delivered to Craig Group in the last two years.

At 58 m (190 ft) long, the *Grampian Fortress* features diesel electric propulsion via twin Azimuth Stern Drives. It is also equipped with daughter craft and fast rescue craft as well as being able to transfer and store limited deck cargo and provide offshore locations with fresh water and fuel if required.

The *Grampian Fortress* will be joined later in the year by the second F-Class ERRV, the *Grampian Freedom*.

Prosafe rigs to provide support in North Sea

Prosafe says an unnamed company has contracted an accommodation vessel for an eight-month program in the UK North Sea.

Initially Prosafe will supply its *Safe Zephyrus* rig for the start of the contract in 2Q 2016. This will be replaced soon afterward by the *Safe Notos*.

The $60-million contract includes four one-month extension options.

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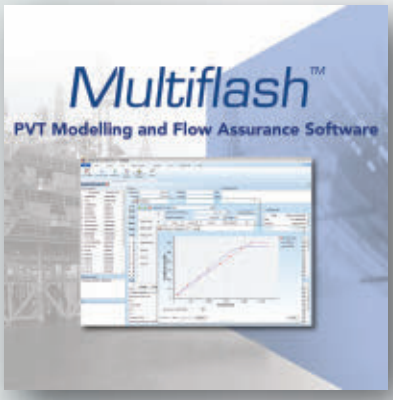

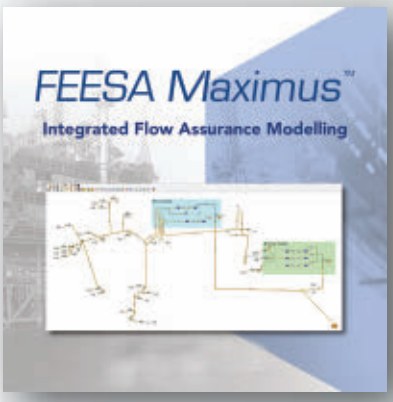

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GoM drilling permits continue to decline

The number of drilling permits issued by the US Bureau of Ocean Management is down, according to Evercore ISI's U.S. Drilling Permit Monthly report dated August 2015. According to Evercore's analysis conducted on the most recent set of drilling permits issued by BOEM, a total of 12 new permits were issued in the US Gulf of Mexico last month, down from 15 in June and down from 42 a year ago. Six permits were issued for side tracks and six were issued for new wells while no permits were issued for bypasses.

Of the new wells, three were for shallow water, two were for midwater, and one was for deepwater, but none were for ultra-deepwater. New well permitting was up from five issued last month but down from 18 issued one year ago. A total of 133 new well permits were issued all last year – up 3% year-over-year, led by a 67% increase in the number of new deepwater permits issued. Year to date, 48 new well permits have been issued, down 42% from 83 issued this time last year.

Despite the significant increase in ultra-deepwater newbuild floaters entering the region, the majority are likely working on deepwater development projects as the development of the Lower Tertiary has yet to truly begin. The oilfield analysis firm said it continued to believe the GoM will be the only relative bright spot for deepwater.

Additionally, according to Evercore's research, Shell filed two ultra-deepwater plans for five exploratory wells with an estimated start date in January, while Stone Energy filed one ultra-deepwater plan consisting of one exploratory well with an estimated start date in April.

DEA, Sterling line up more North Sea wells

Sterling Resources expects a new round of development drilling to start late this year on the Breagh Alpha platform in the UK southern North Sea.

The company, along with operator DEA UK, plan two to four new wells (A09-A12), of which the first (A09 and A10) are currently budgeted. In addition they are considering re-entering (possibly via a side track) and hydraulically fracking production well A01, and a side track/hydraulic frack of another producer.

Front-end engineering and design work started last month for onshore compression at the Teesside Gas Processing Plant in northeast England that receives Breagh's gas. A final investment decision on this project is due in October.

The compression could be operational during the second half of 2017, potentially boosting production (initially) by 40-50%.

The Breagh gas field is the largest field development project in the United Kingdom under DEA UK's operatorship. (Photo courtesy DEA UK)

Last year the partners put Breagh Phase 2 development planning on hold while they assessed drilling results and reservoir characterization of the southeastern areas of the field, based on a 2014 3D seismic survey. They now expect to submit a field development plan addendum for Phase 2 in 2016.

Sterling's blocks 42/2a, 42/3a, 42/4, 42/5, and 36/30, around 25 km (15.5 mi) north of Breagh, contain the Darach and Ossian prospects. The company is trying to farm down its 100% interest during 2015 ahead of drilling a commitment well by the license expiry date of December 2018.

Additionally, Sterling has secured an extension of the license for blocks 49/18b and 19b containing the Niadar prospect until December 2017.

As for the TAQA-operated Cladhan development in the UK northern North Sea, the host Tern platform was shut down in June to enable final tie-in of the topsides and subsea systems prior to commissioning and the start of production from Cladhan at the end of September.

In the Dutch North Sea, Sterling has commissioned a 500-sq km (193-sq mi) 3D seismic survey over its F17 and F18 blocks, with processing and interpretation set to be completed by year-end.

The survey is intended to improve resolution of reservoir distribution and reduce structural uncertainty, as part of a program to evaluate new exploration potential in the area and development options such as a tie-back to a potential new Wintershall oil hub.

The Dutch Ministry of Economic Affairs has extended the licenses until January 2017.

Cobalt aims for year-end sanction for Cameia

Drilling operations have been completed on the Cameia #4 well in block 21 offshore Angola.

According to operator Cobalt International, results were in line with pre-drill expectations. Cameia #4 well will be retained as a producer for the field development.

Recently, drilling started on the Cameia #5 well, and drilling is expected to continue on the field through the rest of this year.

Cobalt is aiming for formal sanction of the project by year-end, followed by first production in 2018.

However, both eventualities remain subject to obtaining financing, and also approval for a revised development plan from partner Sonangol and the Angola Ministry of Petroleum.

Esso Australia wraps up Turrum drilling

Esso Australia has completed the drilling of five new wells in its Turrum gas field development in the Bass Strait. Drilling operations involved four gas wells and one oil well. This follows startup of the $4.5-billion Kipper Tuna Turrum project.

"The program involved drilling approximately 20 km (65,617 ft) of technically complex wells and installing more than 2,000 metric tons (2,204 tons) of casing, tubing, and production equipment," said ExxonMobil Australia Chairman Richard Owen.

"The Esso-BHP Billiton Gippsland basin joint venture continues to supply nearly 40% of east coast Australian domestic gas demand," he added.

Kosmos to continue drilling offshore Mauritania

Kosmos Energy plans further delineation drilling on its Ahmeyim (ex-Tortue) gas discovery offshore Mauritania.

Earlier this year the Tortue-1 exploration well encountered 107 m (351 ft) of net pay in the Cenomanian, and a further 10 m (32 ft) of gas in the lower Albian section. *Atwood Achiever* drilled the Tortue-1 well, designed to test the prospect, 285 km (177 mi) southwest of the capital Nouakchott in 2,700 m (8,858 ft) of water.

Planned TD of the well is around 5,250 m (17,224 ft).

Early analysis of drilling results and intermediate logging to a depth of 4,630 m (15,190 ft) suggests the well intersected 107 m (351 ft) of net hydrocarbon pay, encountering a single gas pool in the primary Lower Cenomanian objective.

The Lower Cenomanian comprises three high-quality multi-Darcy reservoirs with total thickness of 88 m (288 ft) over a gross hydrocarbon-bearing interval of 160 m (528 ft).

In addition, Kosmos expects to spud the Marsouin-1 exploration well in the central part of Mauritanian offshore block C-8 later in the current quarter.

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Seismic survey work remains active in Mexican Gulf

The prospect of acquiring permits offshore Mexico has generated geoscience activities in anticipation of leasing rounds to come.

Schlumberger has expanded its Gulf of Mexico multi-client wide-azimuth seismic data portfolio with a survey in the Campeche basin. The acquisition of the industry's first multi-client wide-azimuth survey offshore Mexico will cover 80,000 sq km (30,888 sq mi) using two fleets of WesternGeco.

Wide-azimuth, long offset, and broadband seismic surveys are needed to address the challenges in the Campeche basin include near-salt and subsalt structures, complex faulted structures, and deep-thrusted structures and to deliver data to support identification of subtle structural and stratigraphic traps, provide better delineation of fractures, and to improve reservoir characterization.

Mexico's Comisión Nacional de Hidrocarburos (CNH) has issued Electromagnetic Geoservices permits to collect as much as 88,000 sq km (33,977 sq mi) of multi-client 3D electromagnetic data in the Salina de Itsmo basin. EMGS said it will prioritize data for future bid rounds.

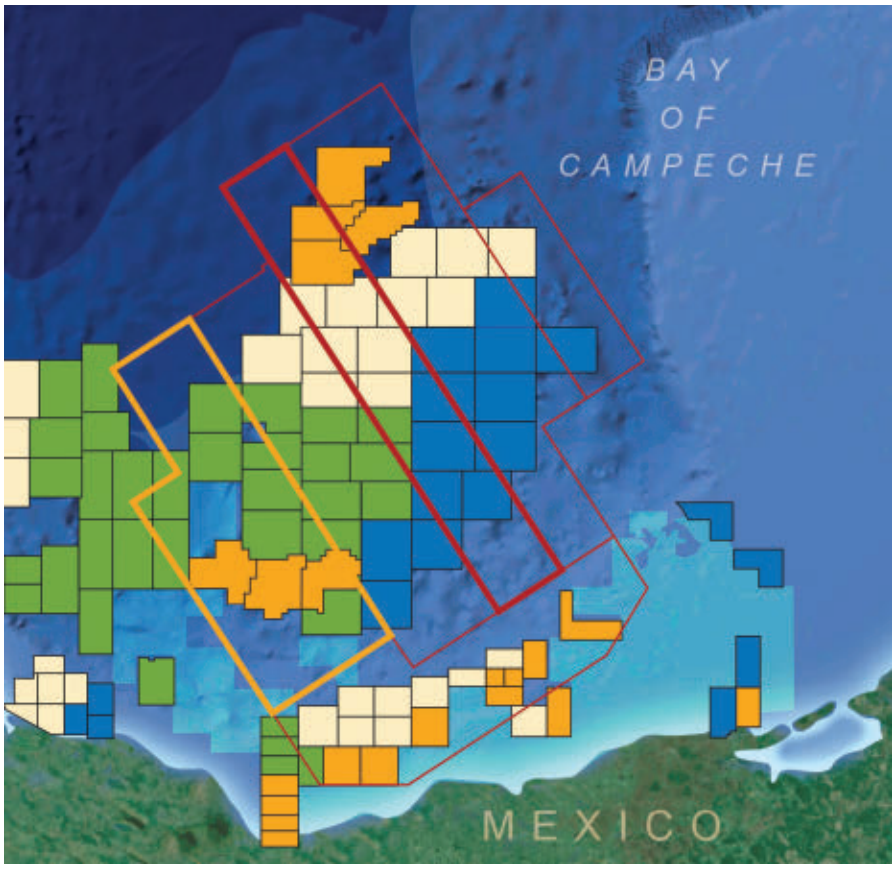
Salinas exploration area encompasses structures with Lower Miocene turbidite systems containing significant channel facies and additional indications for basin floor fans EMGS considers the most attractive reservoir opportunities.

ION Geophysical has launched the first phase of MexicoSPAN, encompassing more than 22,000 km (13,670 mi) of deep-imaged 2D seismic data. Combined with ION's YucatanSPAN, GulfSPAN, and FloridaSPAN programs, MexicoSPAN will deliver a complete, basin-wide regional view of the Gulf of Mexico.

Subsequent phases infill phases will enhance the project with the precise amount of provide 2D data to better identify size and location of major prospective structures before moving into 3D workflows incorporating 3D data soon to be available from Mexico's CNH.

Dolphin Geophysical has commenced the East Campeche 2D long offset multi-client survey in Mexico using the M/V *Artemis Arctic*. The licensed approved 19,597 line km (12,177 mi) is well positioned toward the recently announced five-year plan for leases, and Dolphin says it will be able to deliver time-processed seismic data products in time for the first Mexican license round. The survey is supported by industry pre-funding.

MultiClient Geophysical has started the MCG MC2D campaign offshore Mexico. The program, named "Maximus," comprises 31,600 km (19,635 mi) of seismic data covering the first through fourth round blocks in the Campeche Deep basin, in addition to a regional grid over the Yucatan Shelf and deepwater areas. The program was developed in cooperation with the oil industry. Fasttrack data will be made available prior to the first license round.



Schlumberger has expanded its Gulf of Mexico multi-client wide-azimuth seismic data portfolio with a new survey in the Campeche basin. (Courtesy Schlumberger)

Elsewhere

Polarcus has commenced a 3D broadband multi-client project across the Mauritania-Senegal-Guinea-Bissau basin (MSGB), offshore northwest Africa. The project, supported by industry funding, will cover an area of 1,500 sq km (597 sq mi) offshore The Gambia. Final data products are scheduled to be available in 1Q 2016.

The prefunding has been secured in response to the heightened industry interest in the Cretaceous slope fan and shelf-edge reef plays along the entire MSGB margin subsequent to the recently announced dual well successes in Senegal.

TGS has a new multi-client 3D survey offshore eastern Canada with plans to acquire approximately 4,300 sq km (1,660 sq mi) of data. This survey is conducted in partnership with PGS.

The *Ramform Valiant,* using PGS GeoStreamer technology, will acquire data in Flemish Pass basin over the exploration license 1135. The company says that final data will be available to clients in 3Q 2016.

SAExploration Holdings has announced the award for ocean-bottom marine seismic data acquisition services valued at approximately $47 million.

The company says it expects to execute the project during the second half of 2015.

According to SAExploration, this project will be performed using ocean-bottom nodal seismic recording technology equipped to operate in transition zones and water depths ranging from zero to 3,000 m (9,842 ft). SAE said it will use available equipment and personnel with no new capital expenditures required.

Technology R&D

RSI and Repsol have inaugurated a three-year joint project to develop rock-physics and controlled source electromagnetic interpretation and integration technology.

Repsol and RSI signed an agreement to co-develop a state-of-the-art platform for the integrated interpretation and joint inversion of seismic and CSEM data within a rock physics modeling framework. The joint project will be built upon RSI's existing technology and experience in these fields, and draw on Repsol's geophysical knowledge and exploration expertise. Both Repsol and RSI will own the resulting technology.

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Real-time monitoring systems improve riser integrity and management

Ian Verhappen
Industrial Automation Networks Inc.

Every offshore facility has a riser, but unfortunately not all facilities have real-time monitoring systems to confirm the integrity of that riser. The importance of riser monitoring is demonstrated by the existence of two industry standards: DNV-OS-F201 "Dynamic Risers" and API RP 16Q "Recommended Practice for Operational Inspection of Drilling Risers." In addition to providing much of the theory on which riser monitoring systems should be based, as with all standards, these documents tend to reflect the best practices offered by multiple experts in this area of work.

The common challenges for offshore drilling and production that need to be managed via riser monitoring and associated management systems include: riser curvature, fatigue loading damage, and high tensions at the BOP and base. The causes of these challenges are a result of the environment in which offshore facilities operate. It is impossible to avoid the impact of wave action, tides, and temperature gradients, especially in deepwater installations as well as the pressures of the production system itself. All of these variables are classified into three types of loads on the system:

- Pressure loads – external hydrostatic pressure and internal fluid pressure, both of which can easily be measured and are normally measured for process reasons.
- Functional loads – which include the weight and buoyancy of riser, tubing, coatings, marine growth, anodes, buoyancy modules, contents, and attachments as well as the weight of the internal fluids. Again, these are loads that by and large are under the operator's control or can be managed with proper maintenance.
- Environmental loads – predominantly waves including internal waves and other effects due to differences in water density and floater motions induced by wind, waves, and current.

Calculations from API16Q provide guidance and recommendations on the maximum top tension ranges recommended for drilling risers with corresponding mud weights. However, riser analysis is required to define acceptable tension ranges for in-service loading conditions to manage flexjoint angles, component capacities, and riser fatigue damage. During drilling operations, the mean flexjoint angles should be limited to 1-2° so this does not leave much margin for error.

This is reinforced by Clause B (301) of the DNV specification that states: "The riser's internal and external operating condition should be monitored to reveal whether design conditions have been exceeded. This monitoring should include the recording of riser response and tension (if relevant) as well as the composition, pressure, and temperature of the riser contents. Wall thickness measurements by internal means, e.g. pigs and by external means at selected reference points should be considered."

Real-time monitoring systems provide sequence data, pressure, depth, and stress levels on equipment during the entire life cycle to increase system reliability. These systems can help users predict vortex-induced vibration (VIV), where the drilling riser vibrates perpendicular to the dominant current direction. This phenomenon is responsible for the majority of the fatigue damage in deepwater drilling risers. Because of the uncertainties involved in VIV prediction, it has the potential to be very dangerous. These uncertainties come from various sources: the variation in magnitude and direction of deepwater long-term currents; complex multi-modal characteristics of VIV in the deepwater environment; non-scalability of tank test results that are used to determine potential VIV impact; and uncertainties in the design input parameters which require calibration based on measurements in the field. Installing real-time systems and then comparing the actual results against those predicted by the models will not only improve the reliability of the system but also the veracity of the model as well.

Much of the technology to provide the required life cycle data is available today, but integrating the measurements into a system is the challenge. For example, RFID tagging is frequently used to identify each asset through its life cycle and is being done today by manufacturers as part of their required traceability. So, this technology exists.

Fixed components of the system and production platforms can be connected to the data collection and analysis system installed in the "top works" via wire or fiber. Of course, for non-fixed components such as the riser, during drilling acoustic (water equivalent of wireless) technology can be used to transmit data from subsea to platform for processing. Acoustic transmission can also be used with fixed systems.

Acoustic systems like wireless need to be low power, so they need to be designed to be able to run off batteries. However, the batteries could be charged by waves or the temperature gradient of the water for longer life. One of the simpler instruments capable of providing a significant number of the measurements needed for riser monitoring are based on a strain gauge as part of a Wheatstone bridge, which is common low energy circuit.

Be sure to keep the individual sensors and network simple because it is in a harsh environment that is difficult to access for maintenance. This means put as much intelligence "up top" in software where it can be accessed by local experts who recognize and correlate patterns. Also, if the real-time riser data acquisition system is working properly, the platform control and data capture/archiving system can also be analyzed in real time remotely by experts and quality assurance teams. An additional benefit of using a distributed sensor network is that if one sensor fails, the majority of the system is still functional; and to a certain point, the model and other data points can "fill in" the missing information. Avoid typical engineering of overdesign as represented by bloatware in computers.

One thing that must be avoided is the idea of developing the "perfect" standalone system, since the trend today is to distribute intelligence.

Because the industry is now putting the intelligence in a computer with "unlimited" processing capability, one thing that must be avoided is the idea of developing the "perfect" standalone system, since the trend today is to distribute intelligence. The Internet of Things (IoT) is all about gathering lots of data and then making sense of it in a central location. Improve the operator interface so that the data is presented in a meaningful way. This will allow users to get a better understanding of how a riser system is performing as a part of an integrated offshore platform, and it will also increase the overall reliability and safety as well.

The author

Ian Verhappen, P.Eng., is an ISA Fellow, ISA Certified Automation Professional, Automation Hall of Fame member, and a recognized authority on process analyzer sample systems, Foundation Fieldbus, and industrial communications technologies. Verhappen provides consulting services in the areas of field level industrial communications, process analytics, and hydrocarbon facility automation. Feedback is always welcome via e-mail at iverhappen@gmail.com.

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European Commission issues new offshore safety directive

Richard Lissack, QC
Fiona Horlick
Outer Temple Chambers

The readers of *Offshore* magazine are no doubt familiar with the events and consequences of the April 20, 2010 oil spill in the Gulf of Mexico: the explosion of the *Deepwater Horizon* oil rig and consequent injuries and loss of life; the uncontrolled flow of oil for 87 days; and the largest marine oil spill in the history of the industry. In July 2015, BP agreed to pay $18.7 billion dollars in fines, the largest corporate settlement in US history.

The tragic event prompted the European Commission to look urgently at the safety of offshore oil and gas activities. Initial investigations concluded that there was inadequate assurance that the existing regulatory framework and industry safety practices minimized risk from offshore accidents.

Three years later, the European Commission published the Directive on Safety of Offshore Oil and Gas Operations (Safety Directive). This aimed to reduce and limit both the occurrence and consequences of major offshore accidents, and it required changes to safety regimes and to other areas such as emergency response and environmental protection.

The Safety Directive's requirements matched the existing Offshore Installations (Safety Case) Regulations 2005 (SCR 2005) but it was more detailed, more onerous; and it contained some entirely new requirements. It also only applied to external waters whereas the SCR 2005 applied to both external and internal waters. As a result, the decision was taken to restrict the existing SCR 2005 to internal waters and to implement the Safety Directive though the Offshore Installations (Offshore Safety Directive) (Safety Case etc.) Regulations 2015 (SCR 2015) for external waters.

The SCR 2015 came into effect on July 19, 2015. The new requirements are integrated into UK law and will apply to operators of production installations and owners of non-production installations where those installations are situated or will be situated within the UK external waters – that is the UK territorial sea or the designated areas within the continental shelf. It is important to note that it is the physical location of the installation that brings the operator or owner within UK law, not the location of the operator or the owner, which may be outside the UK.

These new regulations will be treated as Health and Safety regulations under the Health and Safety at Work Act of 1974. They will be enforced by Health and Safety inspectors and the Department of Energy and Climate Change (DECC) inspectors. The HSE and DECC will be working in partnership and will comprise the relevant "competent authority."

The SCR 2015 are regarded as being key to the management of offshore health and safety and environmental major hazards, and they intersect and complement other regulations, integrating environmental protection within safety protection. The definition of "major accident" now includes any major environmental incident – that is an incident which results or is likely to result in significant adverse effects on the environment.

Some existing offshore regulations have been revoked to rationalize the regime and any continuing requirements have been placed within other offshore safety legislation.

Safety cases are required for all installations operating or to be operated in UK external waters. The definition of "installation" goes further than the Safety Directive in order to harmonize with existing UK regulations, and to counter concerns that some structures undertaking activities with major accident potential could fall outside the scope of the SCR 2015.

A safety case must be submitted to the competent authority. It is an offense, punishable by imprisonment and/or a fine, to operate an installation without a current safety case that has been accepted by the competent authority; or to fail to conform to it.

The duty to submit a safety case is generally placed on a single duty holder: the operator of a production installation or the owner of a non-production installation. There are further notification requirements; for example, if a production installation is to be moved to a new location in external waters or a non-production installation is converted to a production installation. If an operator wishes to establish a new production installation, notification must be sent at an early stage.

For existing production and non-production installations, they must have an accepted safety case by July 19, 2016, or by the review date of an existing safety case under the SCR 2005 (whichever comes earlier). The transitional provisions recognize that there is a five-year period to comply (from 2013) and that there are different transitional requirements for those installations that existed prior to the commencement of that five-year period.

The purpose of a safety case is to demonstrate that the duty holder has the ability and means to effectively control major accident risk and, as such, places an extra and rigorous level of regulatory control that builds upon existing regulations.

The safety case should be a comprehensive document covering risk control measures, safety and environmental management systems (SEMS) and verification arrangements. It is intended to be a living document and to be revised as appropriate. There must be a comprehensive review at least every five years. There is a duty to consult with workplace safety representatives and to properly consider any comments (but no duty to accept them).

A Corporate Major Accident Prevention Policy (CMAPP) is a compulsory element of the safety case. It should be a high-level overview of how the management of major accident hazards will be implemented. It should include the outline of arrangements for identification of all hazards with the potential to cause a major accident, the assessment of identified major accident risks and the suitable control measures.

Verification of the safety case is a key component of the SCR 2015. There is a duty to establish, put into effect and maintain a verification scheme. Failure to do so is an offense. An essential preliminary to developing an effective verification scheme is the identification of the installation's safety and environmental critical elements (SECEs). The requirements of verification are rigorous.

The safety case requires a well operator to have the well examined to ensure that it is properly designed, constructed, and maintained.

In any criminal proceedings for contravention of the regulations relating to verification and well inspection, which involve the appointment of a verifier and a well examiner, there is familiar strict liability defense. This involves taking all reasonable precautions and exercising all due diligence to avoid commission where the offense was due to the act or default of another person who was not an employee.

The competent authority has the power to prohibit operations where it judges that there are insufficient measures within a safety case to prevent or limit the consequences of a major accident.

Notification must be given "without delay" of a major accident or an immediate risk of a major accident. Such notification must include the potential impact on the environment and the potential major consequences.

The penalties for an offense committed by contravening a requirement or prohibition imposed under the SCR 2015 are a fine and/or imprisonment with a maximum of two years in the Crown Court or three months in the Magistrates Court in England and Wales or 12 months in Scotland.

The authors

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Future deepwater developments bring challenges, opportunities

Industry needs to manage reservoir uncertainty, improve capital efficiency

The Thunder Horse semisubmersible production, drilling, and quarters platform is the largest offshore installation of its kind in the world. BP recently announced that it would undertake an expansion of the Thunder Horse oil and gas field in Mississippi Canyon blocks 778 and 822 in the Gulf of Mexico, in more than 6,000 ft of water. (Courtesy BP)

Richard D' Souza
Granherne

Demand for oil and gas is forecast to increase steadily for the next several decades. Increasing supply from new deepwater developments will be essential to satisfy this demand, and the growing complexity of future deepwater developments, together with persistent inflation in capital and operational expenditures, has resulted in a dramatic increase in E&P spend by operators in the last five years.

The confluence of increasing project complexity, capital inflation, and the recent plunge in oil prices has created a perfect storm that has roiled the deepwater industry. The upshot has been the cancellation, deferral, or recycling of many deepwater projects. It is clear that business as usual is no longer an option.

While the industry has had considerable success finding large hydrocarbon reservoirs in deepwater, it is spending more each year to develop them while producing less. The complexity, scale, and costs of developing these reservoirs profitably are taxing industry capabilities and causing operators and contractors alike serious financial duress. Operator investment returns have fallen from 25–30% to 10–15%. It has become abundantly clear that the industry has to fundamentally reassess how it goes about the business of developing complex, capital-intensive upstream projects in general and deepwater projects in particular, especially in what could be a substantial period of low oil prices.

The goal here is to address recent trends in deepwater field development that are the root cause of these challenges, and their consequences. Proposed solutions to the more vexing challenges will be presented.

Deepwater trends

A decade ago escalating oil and gas prices were the rising tide that lifted all boats. It essentially bailed out many floundering projects, masked poor project performance, and bred profligacy and complacency.

In the last three to four years, deepwater development capex inflation has been outpacing inflation of oil and gas prices, which have plateaued and dropped by half in the past year. Capex of many deepwater projects routinely exceed $5 billion, driving them into the so-called "mega project" category. Even major operators and contractors with sophisticated project management processes and capabilities are struggling to achieve acceptable commercial results in these circumstances.

Cost inflation of goods and services has accounted for much of the capex and opex inflation since 2004. However, geographic, geologic, and geopolitical trends also conspire to significantly drive up the cost, complexity, and unpredictability of today's deepwater projects.

Geologic trends

From 2000 to 2010, the industry has discovered and successfully produced hydrocarbons in deepwater reservoirs in the Gulf of Mexico, West Africa, and Brazil. Water depths have increased from 4,000 ft to 8,000 ft, and the technologies to develop these deepwater projects have kept pace.

More recently, the industry has discovered large oil and gas reservoirs in deep and ultra-deepwater in Brazil (presalt) and the Gulf of Mexico (Lower Tertiary). These reservoirs tend to occur deep (>25,000 ft) below the mudline or are overlain by massive salt canopies that significantly impact reservoir characterization and increase well construction complexity and cost. They tend to have low permeability, resulting in well productivities that are significantly worse than those of younger reservoirs, which have accounted for most deepwater production to date.

Many of the deeper reservoirs tend to have very high pressures and temperatures that exceed the industry's current ability to produce them. In many cases, the industry lacks production analogues for these reservoirs, which has greatly increased uncertainty in predicting well performance and ultimate recovery, and variables that are fundamental to ensuring the commercial success of a project.

Deepwater challenges

As a consequence of escalating complexity and uncertainty of frontier deepwater projects,

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the industry is struggling to quantify and manage project complexity, capex, and risk required to achieve predictable project outcomes. A recent analysis examined a sample of 130 oil and gas mega projects executed since 2003, and concluded that only about 1 in 5 could be reasonably defined as successful (measured by how well sanctioned cost and schedules are met). The rest were unimpressive with average cost and schedule overruns of 30%. Most deepwater projects today fall into the mega project category.

Recently, many major international and national oil companies (Statoil, Shell, BP, Petrobras, Chevron, Total) have announced that they will keep a lid on capital spending in the short to medium term in an effort to drive capital efficiencies and improve profitability. In addition, onshore unconventionals are competing fiercely for capital allocation, further increasing pressure on operators to improve capital and execution efficiency of deepwater projects.

Stretched supply chain

The supply chain that delivers a deepwater project is vast, global, and encompasses multiple suppliers that include oil field service companies, drilling contractors, lease-operate facility providers, shipyards, fabrication yards, installation contractors, and subsea vendors. In recent years, the demand for their services has escalated dramatically as a result of a massive surge in the number of sanctioned deepwater developments. Contractors in the supply chain are being overwhelmed by the volume, pace, and complexity of these demands. As a consequence, the demand and supply equation is completely out of kilter and this imbalance is a major contributor to capex inflation, project delays, and cost overruns.

Solutions

So what does the industry have to do to get back on the track of producing profitably in deepwater in an environment of increasing project complexity and uncertainty and plunging oil and gas prices? The focus will be on five areas that, if properly addressed, will go a long way toward achieving this goal.

Managing geologic uncertainty

This is at the very core of a successful deepwater development. In frontier deepwater regions, it is imperative for an operator to take the time and spend the capital required to mature reservoir definition and optimize the reservoir recovery plan. Spending the capital required to mature reservoir definition, enhance well performance, and reduce ultimate recovery uncertainty prior to committing major capital outlays will go a long way to prevent project train wrecks. The risk of under or over designing a surface facility can also be managed by configuring a facility layout and size to allow future expansion or debottlenecking, to deal with changing reservoir conditions. Extended well tests, early production systems, and phased developments are other strategies to successfully manage reservoir uncertainty.

Improving capital efficiency

This is a topic that has been endlessly dissected, and many strategies and fixes have been proposed to better predict project costs and schedules at sanction; then executing projects to stay within sanctioned budgets.

The most fundamental admonition, which has been demonstrated time and again, is to not fasttrack project schedules. It has been repeatedly shown to destroy more value than it creates. Accelerated schedules inevitably shorten the appraise, select and define project phases, and therefore increases uncertainty in everything from predicting reservoir recovery to capex and schedules. This is especially shortsighted for complex frontier projects with high local content requirements.

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Therefore, the first step to ensure deepwater project success is to take the time necessary to do a proper front-end loading and define the right project. Planners must also reduce uncertainties in predicting reservoir performance and project costs, and develop a robust execution plan. Understanding the capacity and availability of the supply chain is critical to success. This requires patience and discipline to ensure that qualified contractors and project teams are contracted to execute the project.

Improving efficiency of facility topsides without sacrificing production throughput, safety, or availability is low-hanging fruit, since topsides weight drives facility costs. The industry can no longer afford the luxury of "we have always done it this way," and must reassess and rationalize design philosophies, specifications, and contracting approaches. Standardized topsides design strategy has been effectively incorporated by certain operators (Shell, Anadarko, ExxonMobil) to realize significant savings in project costs and cycle times. Operators are beginning to change their mindset for bespoke over-engineered designs by opening up to more standardized and simplified designs.

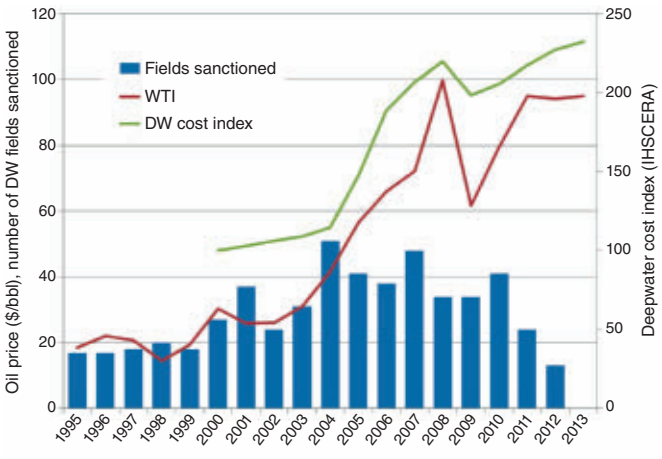
In mature basins, existing infrastructure with declining production can be utilized to enhance recovery or produce reservoirs within subsea tieback distance. These brownfield or expansion projects provide the biggest bang for the buck with significantly reduced risk. Much of the future capex is being targeted for such projects.

Host country requirements

Many deepwater developments are in the golden triangle that includes Brazil and West African nations, particularly Angola and Nigeria. These countries have been steadily increasing local content mandates. In Brazil, for instance, contracts for blocks acquired in the 2013 auction require 37% local content for goods and services in the exploration phase, rising to 55% in the development phase. While local content requirements can and have delivered major benefits to a host country, unrealistic demands have a damaging effect by adding significant costs, increasing bureaucracy, and fostering corrupt practices.

Local supply chains have some combination of inadequate capacity, low productivity, and high labor costs which conspire to inflate costs by 100% or more, causing substantial project delays and increasing HSE risk. It is imperative that host countries recognize the consequences of onerous local content mandates and reset requirements to achieve a more sustainable cost premium that provides host country benefits without jeopardizing project viability.

Oil price, offshore cost and deepwater project starts, 1995-2013.



Source: IHS CERA, Wood Mackenzie

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Production-sharing contracts and tax regimes are getting progressively more disconnected from the capital intensity and risks undertaken by operators. Certain countries are moderating tax regimes to incentivize rather than inhibit new production. Host countries also need long-term policies that are not subject to change after every election cycle.

Technology development and adoption

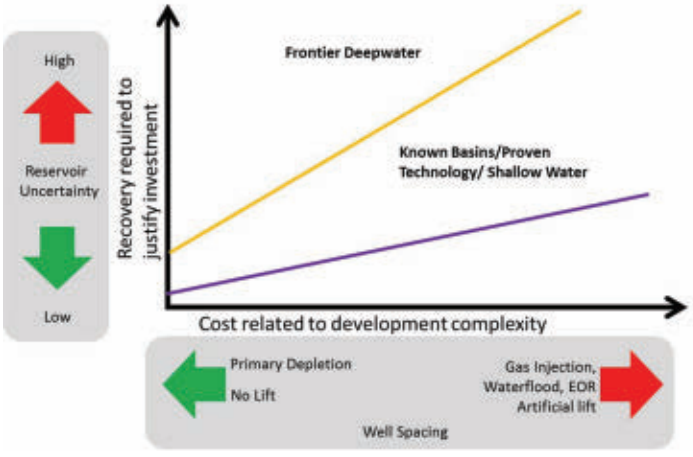
The development of enabling technologies has been a critical factor in unlocking resources from deeper waters and more difficult reservoirs. The industry has progressed from producing hydrocarbons in 1,000 ft of water to 10,000 ft of water in a span of 30 years. The technical challenges of the recent tranche of deepwater projects calls for significant investments in surface and subsurface technology. The investment in enabling and enhancing technologies must be broad and sustained if the industry is to bring on new deepwater production.

Key technologies have to be identified early and advanced to an appropriate technology readiness level before they can be deployed in the field. The development cycle takes many years and is capital intensive. Key technology categories to enable more profitable deepwater production are:

- Reservoir characterization and well placement
- Drilling and completion efficiency
- High-pressure and high-temperature equipment
- Improved enhanced recovery
- Subsea processing and boosting
- Innovative floating platforms and riser solutions
- Cost-effective subsea well intervention.

All of these are being developed to varying degrees by the industry. The key message is that the industry must accelerate the pace of development and adoption of these technologies by adequate and sustained capital commitment.

Required recovery for economic development as a function of reservoir complexity.



Bridging the skills gap

A major challenge facing the industry today is the growing chasm between the rising demand for oil and gas production in deepwater and the growing shortage of technical skills to meet this demand. This is exacerbated by the "great crew change" that is under way. The acute shortage of skilled workers with 20 to 25 years of experience will remain.

The industry is addressing the skills gap from many angles – industry, government, education and training providers – to make a difference in the mid to long term. There are many initiatives under way where academia, industry, and regulators are teaming up and investing in research and training to provide technology and needed skills.

To ensure a sustainable pipeline of talent, the industry can no longer persist in playing the zero sum game of poaching and cannibalizing each other's employees. Instead, it must invest in recruiting, training, and nurturing new talent.

Conclusions

The growing demand for oil and gas will require more deepwater production. Until recently, the industry has had great success in developing deepwater fields. The industry is now on an unsustainable track where capital spending for deepwater developments has increased but production and profits have been falling, while oil prices are forecast to remain depressed for several years.

Additionally, deepwater developments are having to compete for capital allocation with the unconventional market, which has been booming until recently. Operators have reacted by canceling, delaying or recycling new deepwater projects and reducing capital outlays in an effort to rein in costs.

The industry will need to look for ways to manage reservoir uncertainty, improve capital efficiency, and continue to invest in new technologies. It will also need to work with government officials, regulators, and educators to rationalize local content requirements and bridge the skills gap. Many of these initiatives are well underway. The oil and gas industry has always responded to grave challenges that arise periodically, and is at its best when it has its back to the wall.

Acknowledgment

Based on a paper presented at the Deep Offshore Technology International Conference held in Aberdeen, Scotland, Oct. 14-16, 2014.

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Gulf operators move forward with benchmark projects

Anadarko, Shell continue to break deepwater records

Anadarko's Lucius field and ExxonMobil's South Hadrian field produce through the Lucius truss spar. (Photo courtesy Anadarko Petroleum Corp.)

Sarah Parker Musarra
Editor

While exploration and rig counts in the Gulf of Mexico (GoM) are down, multiple projects in the deep and ultra-deepwater Gulf continue to head in the same direction: down, into deeper waters. Due to FIDs made prior to the declining oil prices, deepwater GoM projects have ventured into increasingly deeper water and will progress into yet-unforeseen depths in 2016.

Three years after its December 2011 sanction, the Anadarko Petroleum Corp.-operated Lucius field entered production on Jan. 16, 2015. Spanning blocks 874, 875, 914, and 915 in the Keathley Canyon area of the US GoM, the American independent has estimated the Lucius oil and gas field's recoverable resources at 300 MMboe.

Lucius became Anadarko's fifth deepwater GoM discovery in December 2009 when an exploration well encountered 200 ft (nearly 61 m) of net pay in subsalt Pliocene and Miocene sands. The ultra-deepwater *Ensco 8500* semisubmersible drilled to a total depth of about 20,000 ft (6,096 m) in approximately 7,100 ft (2,164 m) of water during operations.

In January 2012, an up-dip side track well about 3,200 ft (975 m) south of the discovery well cemented Lucius' status as a major GoM discovery, encountering about 600 net ft (183 m) of oil and gas pay, again in subsalt Pliocene and Miocene sands.

At the time of its December 2011 sanction, Anadarko and its co-venturers announced that the field, which is located in around 7,100 ft (2,164 m) of water, was to be developed with a truss spar. The spar, which would bear the name of the field, would have the capacity to produce more than 80,000 b/d of oil and 450 MMcf/d (12.7 MMcm/d) of natural gas. Lucius was developed with six subsea wells tied back to the truss spar. As the largest spar built to date by Anadarko, Lucius has a diameter of 110 ft, is 605 ft-long, and is stabilized by a hull that weighs 23,000 tons.

Anadarko confirmed that it had reached its nameplate capacity in its 2Q operational report, the company's most recent.

Technip was tapped to engineer, construct, and transport that spar hull in August 2011. Consistent with the contractor's previous spar projects, the detailed hull design and fabrication was completed in its yard in Pori, Finland. Located in such extreme water depths, the spar is moored by nine Ballgrab ball and taper mooring connectors attached to polyester mooring lines, supplied by First Subsea Ltd. through a sub-contract issued by Technip.

Two major fields in the GoM produce through the Lucius spar. In July 2011, months before the $2-billion Lucius project was to be sanctioned later that year in December, Lucius' co-venturers agreed with Hadrian South owners to process the field's natural gas through the Lucius facility. The ExxonMobil-operated Hardian South field began producing on March 30, 2015.

Located in Keathley Canyon block 964, Hadrian South is a subsea production system with flowlines connected to Lucius. Located in 1.5 mi (2.4 km) of water, ExxonMobil said Hadrian South's subsea tieback represents the company's deepest to date. Production is expected to reach approximately 300 MMcf/d (just under 8.5 MMcm/d) of gas and 3,000 bbl liquids from two wells. In its 2Q operational report, Anadarko said that production rates had currently stabilized at 300 MMcf/d.

Rendering of *Turritella*, Shell's first FPSO in the Gulf of Mexico. (Image courtesy SBM Offshore)

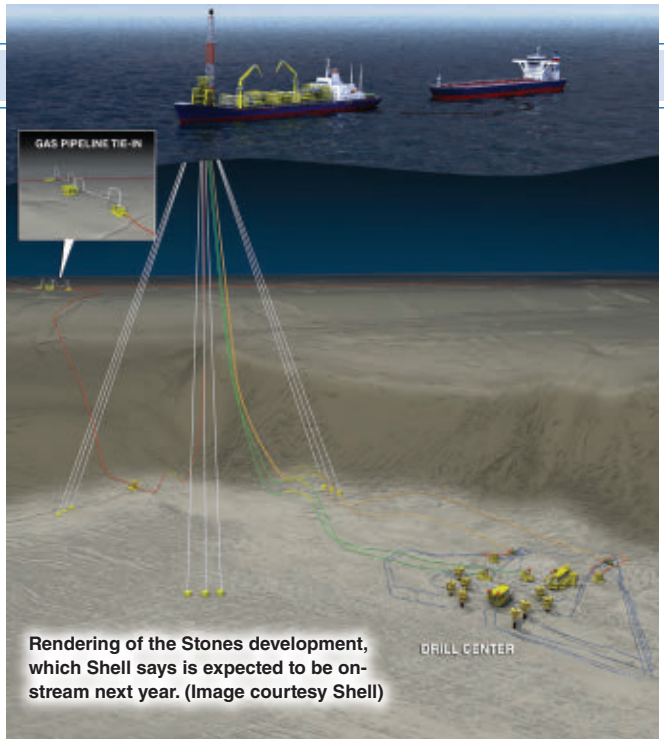
Just as the spar is responsible for the production of two fields, the spar's design is responsible for two production units. Part of Anadarko's "design one, build two" philosophy, the spar Anadarko calls its "most technically advanced to date" is currently being replicated in its Heidelberg spar. The company said this philosophy accelerated the anticipated date of first oil by around 18 months, and is expected to reduce fabrication time by about 40%, and engineering time by more than 50%. Slated for the Heidelberg field in Green Canyon block 903, the Heidelberg spar will be located in 1,620 m (5,310 ft) of water and is designed to produce 80,000 b/d of oil and 2.3 MMcm/d (81 MMcf/d) of natural gas. Anadarko confirmed that the development remains on track to begin producing in 2016.

As with Lucius, Technip is also overseeing engineering and construction of the Heidelberg truss spar. In its 2Q operations report, Anadarko said that Heidelberg's main topsides module has been fabricated and is now with the commissioning team. The hull is on location and the mooring lines are completed. Installation operations for flowlines, export lines, and suction piles for the mooring system are now complete. Umbilical line installations are scheduled for 3Q 2015.

Future depths

When Shell brings its Stones ultra-deepwater oil and gas development into production, it will achieve a host of company and industry firsts, as well as topple a record set by another of the company's own GoM production facilities.

Estimated to hold 2 Bboe in place, Stones



Rendering of the Stones development, which Shell says is expected to be on-stream next year. (Image courtesy Shell)

is located about 200 mi (320 km) southwest of New Orleans in the Walker Ridge area. The field's water depth is 9,500 ft (~2,900 m), nearly 1,500 ft deeper than Perdido. The phased development will begin with two subsea production wells tied back to the *Turitella* FPSO. Six additional wells with multi-phase pumping will be added later; all eight wells will be connected to the FPSO through a single drill center.

Turritella will be Shell's first FPSO in the GoM.

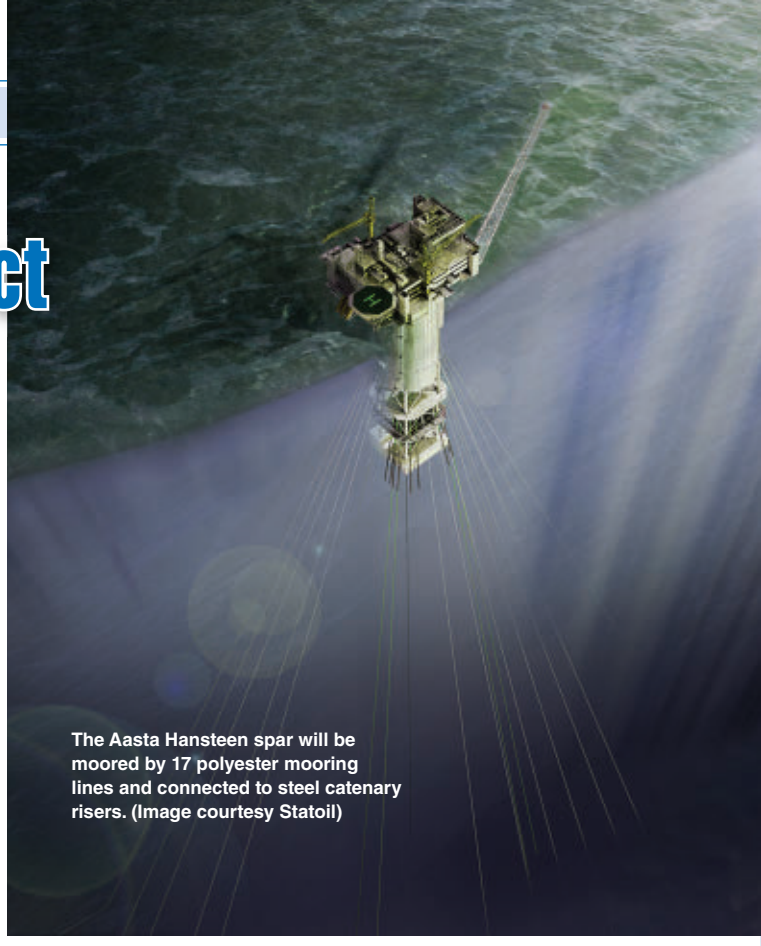
In a collaboration that reaches back to 1958, when the two companies worked together in fabricating the first single buoy mooring, Shell selected SBM Offshore to supply the Stones FPSO following its FID in May 2013. Stones' water depth and other challenges spurred technological innovations within *Turitella*. As an example, due to the GoM's perilously hurricane-prone location, SBM Offshore said *Turritella* will feature the world's largest disconnectable buoy. Known as buoyant turret mooring, the system consists of said disconnectable mooring buoy and a fixed turret structure located in the forepeak of the tanker. The fixed turret extends up through the tanker, supported on a weather-vaning bearing and contains the reconnection winch, flowlines, control manifolds, and fluid swivels located above the main deck. If needed, the vessel can detach and safely sail away to sheltered waters in the event of a hurricane or other emergency event. This detachability is designed to allow the FPSO to quickly resume production. *Turritella* will also employ steel lazy-wave risers on a disconnectable production unit for the first time. Also, aboard Stones, mooring line tension is adjustable without any device installed on the FPSO.

"*Turritella* will be the deepest production facility in the world," a Shell spokesperson told *Offshore*. "FPSO construction in Singapore is progressing well, and Shell has drilled two wells that are moving toward completion." Company officials say that Stones remains on track for a 2016 start-up, which will ramp up to produce approximately 50,000 boe/d.

Shell's focus on ultra-deepwater GoM play does not end with Stones. Kory Kinney, specialist, Field Development for IHS, explained that 52 fields are slated to come onstream in the GoM during 2015-2016. Of these, he said, three fields in water depths of or surpassing 7,500 ft are scheduled to come onstream in 2016, and all three are Shell projects. Beyond Stones, the rest of the list comprises Coulomb Phase 2, and Perdido Phase 2.

Aasta Hansteen project marks several firsts offshore Norway

Jessica Tippee
Assistant Editor



The Aasta Hansteen spar will be moored by 17 polyester mooring lines and connected to steel catenary risers. (Image courtesy Statoil)

Norway's first deepwater development, Aasta Hansteen, is expected to see first production in 4Q 2017. Discovered by BP in 1997, the field, formerly known as Luva, lies in 1,300 m (4,265 ft) of water in the Vøring area, 300 km (186 mi) offshore. The Aasta Hansteen gas/condensate field consists of three discoveries: Luva, Haklang, and Snefrid South, with estimated recoverable reserves of 47 bcm (1.7 tcf) of dry gas.

Operator Statoil holds 51% interest, along with partners Wintershall Norge AS (24%), OMV (Norge) AS (15%), and ConocoPhillips Skandinavia AS (10%). The plan for development and operation was submitted in December 2012 and approved by the Norwegian Ministry of Petroleum and Energy in June 2013.

The $4.8-billion Aasta Hansteen field development represents a number of firsts on the Norwegian continental shelf in terms of water depth and technological solutions. Development calls for the world's largest, and Norway's first, spar platform. It will also be the first deepwater floating production platform installed north of the Arctic Circle using steel catenary risers, and will be the first spar to store produced condensate.

Hyundai Heavy Industries in cooperation with Technip are building the spar platform with a 198-m (650-ft) long hull. The platform is designed to produce 23 MMcm/d (812 MMcf/d) of gas and store 160,000 bbl of condensate. The condensate will be loaded to shuttle tankers at the field. The topsides dry weight will be 23,000 metric tons (25,353 tons), with accommodation for 100 personnel, and the hull dry weight will be 46,000 metric tons (50,706 tons).

HHI aims to have the platform ready for tow-out in summer 2016, followed later in the year by mechanical completion. The spar substructure and topsides will be transported from South Korea to Stord, Norway, on separate heavy-lift vessels.

Polarled, the first pipeline to extend Norway's gas infrastructure into the Arctic Circle, will transport gas from the Aasta Hansteen field in the Norwegian Sea to the terminal at Nyhamna in western Norway. In March, Allseas' *Solitaire* started laying the 482-km (300-mi) long, 36-in. pipeline. The pipeline will have capacity of 70 MMcm/d (2.47 bcf/d).

Statoil is operator of the Polarled development phase, while Shell is responsible for preparing the Nyhamna processing plant to receive the extra gas supplies. Gassco will become operator of the pipeline and the plant after Aasta Hansteen comes onstream.

In June, three subsea templates, built by Aker Solutions in Sandnessjøen, were installed ahead of schedule. According to Statoil, all are of a new design in which the top structure is separated from the base structure. This allows the templates to be installed in deep and rough waters using a smaller installation vessel. *Boa Sub C*, which performed the work, has a lifting capacity of 400 metric tons (441 tons).

The six structures comprising the three templates weigh between 120 and 190 metric tons (132 and 209 tons) each. The upper structures rest on the top of the three suction anchors – another new design – also built by Aker Solutions in Sandnessjøen.

Normally Statoil would employ four suction anchors per template, but in this case, one is sufficient. The suction anchors are 22.5 m (74 ft) high, with a diameter of 7.5 m (24.6 ft) and a weight of 123 metric tons (135 tons) each. They sink around 6 m (19.7 ft) into the seabed under their own weight before being sucked 18 m (59 ft) down until only a couple of meters protrude.

Also in June, Aasta Hansteen's subsea manifolds, built by Aker Solutions in Egersund, were also installed, and they too are of a new design to suit deeper water/rough weather installations.

The foundation plate for the Polarled pipeline end station and the umbilical riser base also are now in place.

Subsea 7's vessel *Normand Oceanic* was next due to install the control cables, provided by Aker Solutions in Moss. Later this summer, installation of the 17 suction anchors that will moor the spar platform itself will begin, as well as eight more suction anchors that will hold the risers in place. Momek in Mo i Rana is supplying all these structures. The risers and pipelines will be installed next year.

This year, Statoil has drilled three successful exploration wells in the Aasta Hansteen area. Most recently, the semisubmersible *Transocean Spitsbergen* drilled well 6706/11-2 on the Gymir prospect in PL602 and encountered a 70-m (229-ft) gas column in the Nise formation with good reservoir qualities. Statoil estimates recoverable volumes in the 6-19 MMboe range, lifting the total discovered this year in the area to 75-120 MMboe – the earlier finds were Snefrid Nord and Roald Rygg. This is equivalent to roughly one-third of the Aasta Hansteen recoverable volumes. All three fields will undergo assessment for future tie-ins to the Aasta Hansteen facilities to prolong the production plateau.

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Total's Egina oil field to come online in 2017

Deepwater project complies with Nigerian content law

Robin Dupre
Sr. Technology Editor

An FMC Technologies subsea manifold is lowered into the water as part of the development of Total's Egina field, located 150 km (~240 mi) off the coast of Nigeria. (Courtesy FMC Technologies, Inc.)

Spanning an area of 500 sq mi (1,295 sq km) in the Niger Delta block OML 130 is the Egina oil field, situated in a water depth of 5,085 ft (1,550 m).

The $15-billion project is under development with production slated to begin by the end of 2017. The fabrication portion of the project is scheduled for completion by the end of 2016 while integration work will start in January 2017. Total serves as the operator of the field with a 24% stake. Partners include CNOOC (45%), Petrobras (16%), and Sapetro (15%).

This project is the first major deepwater development in Nigeria since the Nigerian Content Act was signed into law in April 2010. According to Total, this meant that the requirements of the act were integrated into the project from the beginning and fully embedded in the scope of work of each of the contract packages.

"The Egina project takes technology and skill transfers to a new level," Total stated on its website, "giving Nigeria the full benefit of Total's deep offshore experience and expertise. At the end of 2017, the start-up of the Egina development will reinforce Nigeria's deepwater production potential."

Locally-worked hours will reach about 75% for Egina as part of a plan to boost local content of Nigerian projects, Total added. Development of this project is expected to employ 1,500 people at its peak construction period.

Total said: "All the basic engineering work was done locally – a first in Nigeria. Total successfully met this 'sustainability target' by ensuring teamwork between international companies and local contractors to accelerate the pace of technology transfer and the training of the local workforce."

Field development

Egina, situated 20 km (12 mi) southwest of the Akpo field complex in the same license, was discovered in December 2003 with the Egina-1 well. Following the discovery, the appraisal well Egina-2 was drilled in October 2004, which was followed by further seismic processing and drilling of three additional wells within September 2006 and January 2007. The light oil is rated at 28° API, and the estimated reserves are in excess of 550 MMbbl.

Originally, Total planned to develop the Egina field as a subsea tieback to the *Akpo* FPSO. However, after the field yielded several promising discoveries, the operator decided Egina was suitable for stand-alone development. Basic engineering studies of the field commenced in 2008 and a range of field development options for the field were assessed, but the operator chose an FPSO development option, which received a green light from the Nigerian authorities in 2009.

The field's infrastructure will consist of a subsea production system tied-in to an FPSO unit with a processing capacity of 200,000 b/d and a storage capacity of 2.3 MMbbl. The production system includes risers; 52 km (32 mi) of oil and water injection flowlines; 12 flexible jumpers; 20 km (12 mi) of gas export pipelines; 80 km (52 mi) of umbilicals; and subsea manifolds.

The development plans call for 44 wells connected to a 330-m (1,083-ft) long, 61-m (200-ft) wide, and 34-m (112-ft) high FPSO. It also will have topsides modules with a gross dry weight of 34,000 tons. The design of the FPSO includes capacity for future developments of nearby discoveries, according to Total.

In July 2010, J P Kenny and MCS Kenny, part of Wood Group, alongside Dover Engineering, completed the first comprehensive front-end engineering and design (FEED) undertaken locally in Nigeria for the Egina field development. Total Upstream Nigeria Ltd. awarded the FEED to Dover Engineering in July 2009, and Dover contracted J P Kenny and MCS Kenny to support the project delivery. The subsea scope of work included comprehensive design studies and engineering assessments; development of specifications; documentation and technology studies relating to the design of the umbilicals; flowlines; risers; and the subsea production system of the field's development.

In June 2013, Saipem received a $3-billion engineering, procurement, fabrication, installation, and pre-commissioning contract for the project. Most of the fabrication is being performed in Nigeria, with marine installations to follow during 2016 and early 2017. The entire Egina UFR (umbilicals, flowlines, and risers) project is run from Saipem Contracting Nigeria's premises in Lagos, and most of the engineering is being performed in Nigeria, either in-house by Saipem or by DeltaAfrik Engineering Ltd.

Also in 2013, FMC Technologies received a $1.2-billion engineering, procurement, construction, and commissioning contract to provide subsea production systems for the project. FMC Technologies subcontracted Aveon Offshore in January 2014 to provide fabrication services for the subsea structures in the field.

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Mexico opens its deepwater frontiers to new exploration

Ricardo Martínez
Mexico City

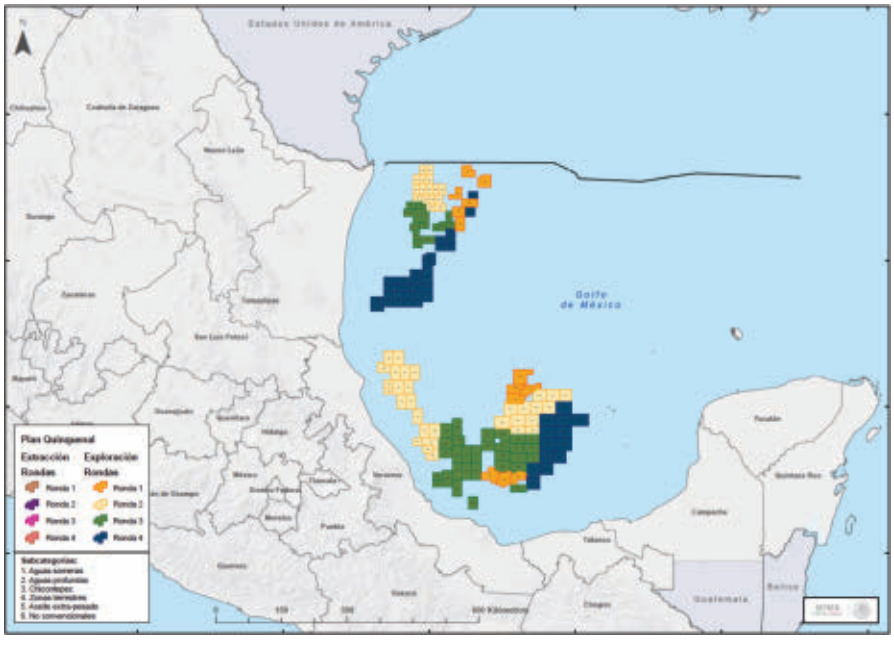
Significant resources await investment, development

Despite enjoying high offshore yields for many years, there is still plenty of untouched potential in Mexico's offshore acreage. After the discovery of Lakach in 2007, other important finds paved the way for Mexico's deepwater exploration for the next five years. Then, just across the maritime border from Shell's Perdido play, PEMEX had a discovery that could signal a new era of prosperity.

In 2012, Trion-1 was drilled to a total depth (TD) of 6,119 m (20,075 ft) about 40 km (25 mi) south. Seen as a landmark discovery, the national oil company (NOC) PEMEX went on to explore for more deepwater prospects. To date, out of the six wells PEMEX has drilled in the area, five have proved fruitful primarily containing light oil and wet gas. Supremus, Maximino, and Exploratus were drilled through 2014 proving the commercial value of the Mexican Perdido play.

Given that PEMEX was given only a part of Perdido's total 26,892km^2 prospective area before auctioning it off, plenty of potential is up for grabs. Productive Cretaceous carbonates and Tertiary sequences have been found according to the NOC's exploration reports. However, the extent of the exploratory program has not allowed for much delineation yet.

The potential is vast, and while current oil price conditions may pose challenges to investment commitment, the future reward should be looked at more closely. According to the country's Ministry of Energy (SENER), a total of 9.7 Bboe of P50 resources will be tendered in four rounds through 2019. Of these, Round One will see 654 MMboe of P50 resources in 13 blocks, six of which are located in Perdido offering 515-698 km^2 areas.



All areas to be tendered through 2019 per distinctive round (i.e. Round One exploration areas colored in dark yellow). Source: "Plan Quinquenal 2015-2019," SENER, 2015.

The other seven blocks are located north of the southern coast of the state of Veracruz with areas ranging from 770-1,000 km^2. Denominated as Salina del Istmo basin, the area has barely been explored. According to PEMEX's findings through a couple of wells, Neogene traps are thought to hold gas and condensate. Nevertheless, the location is still not well characterized yet.

Wells drilled in Mexican Perdido

Well	Completion Date	Rig	TD (m)	Potential
Trion-1	2012	Bicentenario	6119	Oil
Supremus-1	2012	West Pegasus	4029	Oil
Trion-1DL	2014	Bicentenario	4550	Oil
Exploratus-1	2014	West Pegasus	5930	Oil and gas
Vespa-1	2013	Bicentenario	3418	Oil and gas
Maximino-1	2013	West Pegasus	6621	Oil and gas
Maximino-1DL	2015	West Pegasus	6000	Oil and gas

Fortunately, the National Hydrocarbons Commission (CNH) has recently awarded numerous exploration contracts to carry out 2D and 3D seismic among other geological studies in practically the whole Mexican side of the Gulf. TGS AP Investments AS, PGS, Spectrum ASA, and Dolphin Geophysical will survey a total of 2,163,802 km^2 in the coming two years – over 50% of what PEMEX has done over the past 45 years.

Similarly, just this past May, Norwegian MultiClient Geophysical ASA and Houston-based GX Technology were authorized to also acquire 2D seismic; and CGG, EMGS, and Schlumberger will be carrying out 3D seismic throughout the Gulf. The purpose of these exploratory efforts is to build up data to sweeten the opportunities ahead. By July of this year, 12 out of 21 exploration projects had been approved, and were scheduled to be completed by the end of 2016.

In addition to the current efforts, roughly 36,500 km^2 of 3D seismic have already been collected in the Mexican Perdido play, while

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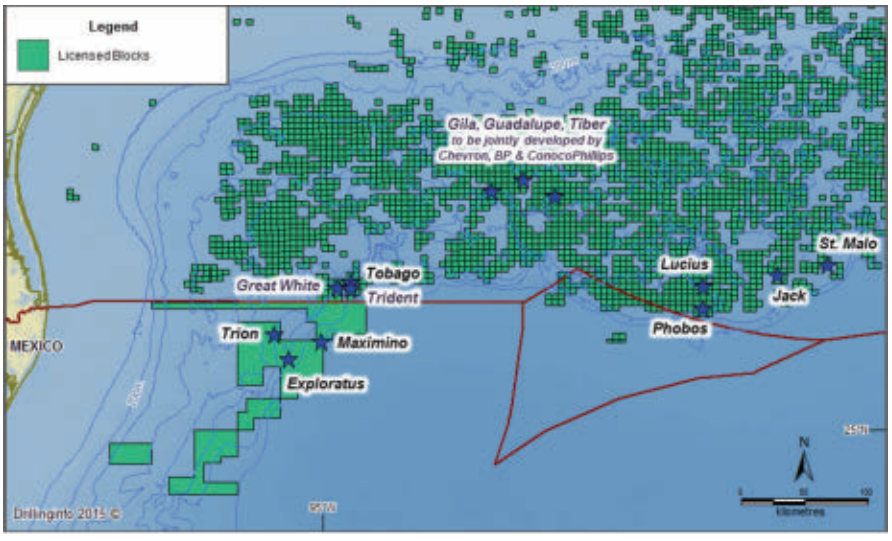

Relative location of Mexican Perdido (Trion, Maximino, and Exploratus) with respect to developments in the US. Source: DrillingInfo, 2015.

the deepwater portion of the Salina del Istmo basin almost reaches 52,500 km^2.

Essentially, the country's subsequent tenders will become a very attractive option for private investment given increased data availability. Also, in opening opportunities to carry out additional surveys by specialized firms, the market for seismic collection and additional studies will bloom over the next few years.

Apart from the upcoming rounds, boasting over 960 MMboe of 3P reserves combined, Trion, Exploratus, and Maximino are expected to be included in PEMEX's farm-outs over the next two years. Similarly, two gas giants in the vicinity of Lakach – Piklis and Kunah – will offer a chance for private players to develop a total of 771 bcf and 1.7 tcf of 3P reserves with the NOC.

With 3P reserves reaching 300 MMboe, production at Trion is expected to reach 80,000 b/d of 25° to 29°API crude. Current development plans include 16 wells, three subsea production centers, one floating production system (FPS), and one fixed platform at 100 m depth to pump production inland via two flowlines to Matamoros, Tamaulipas.

Regarding Exploratus, current 3P reserves stand at 234 MMboe, which may increase to 279 MMboe once delineation well Exploratus 1-DL is completed next year. Current estimates cap future production of 23° to 36° API crude at 45,000 b/d – a figure that may be increased by 2016. According to PEMEX, a direct tieback to Trion's FPS through two subsea flowlines will allow production to be transported onshore. Eight additional wells have also been projected.

Located close to Exploratus, Maximino is thought to hold 430 MMboe of 3P reserves. Production may reach 93,000 b/d of 43° API crude. This prospect's productive horizons are the same as Trion and Exploratus – Lower Miocene. The Maximino 1-DL well was recently completed, proving further potential in Middle Miocene formations. The conceptual development design is very similar to Trion, where an FPS should receive outputs to be sent to a shared fixed platform and then be delivered to shore.

Located in an area where no exploration blocks will be awarded during Round One, Piklis and Kunah expect massive developments that could be paired up with Lakach's production in the coming years. Both are in an area that is called Cordilleras Mexicanas, just southeast of Salina del Istmo basin and east of the Veracruz port.

Production at Kunah is due to be online by the first half of 2017 and may reach up to 600 MMcf/d. On the other hand, Piklis is expected to produce 260 MMcf/d on average and will have a tieback to Kunah's FPS, which will route outputs to Lakach and then to shore.

While the timeline of these opportunities has not really been defined, PEMEX has revealed that it is seeking partners that can bring expertise and operating experience in similar deepwater developments. In this case, key players in the US GoM are certainly the best candidates. According to the NOC, the farm-out petition to SENER for these five assets was expected to take place this past August.

Fundamentally, enticing world-class operators is the goal, which in return will haul specialized service companies into the country. Although oilfield services giants like Schlumberger, Halliburton, and Weatherford have been key players in the country for decades and leading offshore drilling companies such as Seadrill and Grupo R are well-positioned in the market, bringing in the wide array of products and services designed for deepwater operations will usher in more opportunities in the future.

While the assets and oil potential are there, Mexico's first out of five phases of its historic licensing round did not signal what most were expecting. After having only awarded two of 14 shallow-water exploratory areas up for bid, it seems that something else went wrong beyond the current oil price environment. Some claim that rescission terms in the contracts, as well as the sizes of the blocks, had a significant discouraging effect on interested parties.

In the case of the deepwater acreage, blocks are significantly larger. However, the contract's specific terms have yet to be announced. Production-sharing contracts (PSCs) were deemed the most suitable regime for the first shallow water areas already tendered – as well as the upcoming five production blocks to be awarded by Sept. 30. Nonetheless, many analysts have said that profit-sharing agreements may be used for deepwater contracts.

To date, the Mexican PSC has been modified two times to adapt to industry's commentary and criticism. Now, the bodies in charge of administering contracts – the Ministry of Finance (SHCP), SENER, and CNH – have come up with the final PSC version. While it is possible that a slight variation of this contracting regime may be used for deepwater, the nuts and bolts have not been defined yet.

Moreover, the newly created agency that will oversee all offshore production procedures – Safety, Energy and Environmental Protection Agency (ASEA in Spanish) – is still in its early days as an organization.

All in all, and despite delays in the projected timeline caused by the first tender's underwhelming 14% interest, Round One's deepwater tender should be out by the end of September.

With only 17.5% of Mexico's deepwater prospective resources held by PEMEX, the rest awaits to be tamed by foreign stakeholders. Tapping into the untouched Mexican Gulf will surely be the national oil and gas industry's renaissance, but it will depend upon how successful the Mexican government is in its efforts to woo private investors and E&P firms with deepwater experience. In the end, foreign companies will demand very attractive terms to put Mexico at the top of their international portfolios.

The author

Ricardo Martínez Díaz Francés is a Latin America oil and gas analyst. With a BD in geology from the University of Texas, he has combined technical knowledge with industry expertise to deliver specialized reports for different media sources. For the past two years, he has worked for energy consultancies and other related outlets to assess Mexico's hydrocarbon potential, both from a resources perspective and a business-oriented outlook. Also, he has been closely involved with the implementation of the country's unprecedented energy reform and has studied the effects, both positive and detrimental, to the overall state of the national oil and gas industry. Currently, he lives and works in Mexico City.

Q&A

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The 2015 Environmental Drilling and Completions Fluids Directory is a listing of industry fluid manufacturers and their individual products. The directory is differentiated into 19 sections based on type of fluid. Fifty participating companies and distributors are listed in the directory. Each listing includes new and updated products provided by each company with a description of the product and its general characteristics. With regulations and guidelines for the North Sea operational sectors requiring substances/preparations used and discharged offshore that are considered to pose little or no risk (PLONOR) to the environment listing and Harmonized Offshore Chemical Notification Format (HOCNF) rating, this information is listed in the directory.

The accompanying survey is modified to accommodate for space.
For complete listings, visit the online survey at www.offshore-mag.com/surveys.html

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Decatur, Illinois 62526
(800) 637-5843
bruce.sebree@adm.com

AES Drilling Fluids, LLC
11767 Katy Freeway, Suite 230
Houston, TX 77450
281-556-5628
Mandy.Nelson@AESFluids.com

Akzo Nobel Functional Chemicals BV
Lispinweg 6
6075 CE Herkenbosch
The Netherlands
+31 475 539292

American Gilsonite Co.
29950 South Bonanza Highway
Bonanza, Utah 84008
(435) 789-1921

Aqua-Clear Inc.
608 Virginia Street, East
Charleston, West Virginia 25301
(304) 343-4792

Aqualon
Oil and Gas Technologies
1313 North Market Street
Wilmington, Delaware 19894-0001
(800) 345 0447

ASAP Fluids Pvt. Ltd.
203-204, Kailash Commercial Complex,
L B S Marg, Vikhroli West,
Mumbai 400083
91-22-25789930
prakashmanve@asapfluids.com

Baker Hughes Drilling Fluids
2001 Rankin Road
Houston, Texas 77073
(713) 625-4200
Erica.Bundick@bakerhughes.com

Baroid Fluid Services
3000 North Sam Houston Parkway
Houston, Texas 77032
(281) 871-4135
William.Fitzgerald@halliburton.com

BASF
3120 Hayes Road, Suite 200,
Houston, Texas 77082
(832) 775-7223
jordan.guidry@basf.com

Boysenblue/Celtec International Inc.
P.O. Box 53648
Lafayette, Louisiana 70505
(337) 233-1121
cathyp@boysenblue.com

Cabot Specialty Fluids
Cabot House
Hareness Circle
Altens Industrial Estate
Aberdeen, Scotland
AB12 3LY
(44) 1224 897 229
lenus_king@cabot-corp.com

Cesco Chemical
100 Cesco Lane
Lafayette, Louisiana 70506
(337) 984-4227
frankm@cescochem.com

Chemstar Products Co.
3915 Hiawatha Avenue
Minneapolis, Minnesota 55406-3203
(612) 722-0079

Chemtotal Pty Ltd.
Deepak Charan
deepak@chemtotal.com

Croda Inc.
300-A Columbus Circle
Edison, New Jersey 08837
(732) 417-0800
Susan.Shapiro@croda.com

Deep South Chemical Inc.
P.O. Box 80657
Lafayette, LA 70598-0657
(337) 837-9931
warrenray@deep-south-chemical.com

Drilling Specialties Co./
Chevron Phillips LP
P.O. Box 4910
The Woodlands, Texas 77387-4910
(832) 813-1879
watsoe@cpchem.com

Drillsafe Janel Int.
Polanska 35
43-450 Ustron, Poland
(48) 33 854 3000
biuro@drillsafe.com.pl

Elgin Separation Solutions
10050 Cash Road
Stafford, Texas 77477
(281) 261-5778

Elkem AS, Materials
Unit 17, Jessops Riverside, Brightside Lane,
Sheffield, S9 2RX
+44 1334 650012
chris.steele@elkem.no

Emery Oleochemicals GmbH
Henkelstrasse 67
40589 Duesseldorf, Germany
(49) 211 5611 2502
timo.baecker@emeryoleo.com

Grain Processing Corp.
1600 Oregon Street
Muscatine, Iowa 52761
(866) 268-3561
david_cali@grainprocessing.com

Gumpro Drilling Fluids Pvt Ltd.
LBS Marg, Vikhroli West
Mumbai 400 083, India
91-22-25793280
anandgupta@gumprodf.com

Impact Fluid Solutions
2800 Post Oak Blvd. Suite 2000
Houston, Texas 77056
(713) 964-7736
info@impactfluids.net

Kelco Oil Field Group
10920 W. Sam Houston Pkwy. N., Ste. 800
Houston, Texas 77064
(713) 895-7575

Lamberti SPA
Via Marsala 38 – Torre D
21013 Gallarate (VA)
Italy
(39) 0331-715701
stefano.crespi@lamberti.com

Lamberti USA Inc.
P.O. Box 1000
US 59 @ County Road 212
Hungerford, Texas 77448
(281) 342-5675
luigi.nicora@lamberti.com

Liquid Casing Inc.
P.O. Box 56324
Houston, Texas 77256-6324
(713) 785-0594

M&D Industries of Louisiana Inc.
P.O. Box 82007
Lafayette, Louisiana 70598-2007
(337) 984-0471
rcope@ultrasealinc.com

Mayco Wellchem Inc.
1525 North Post Oak Road
Houston, Texas 77055
(713) 688-2602

Messina Inc.
8131 LBJ Freeway, Suite 180
Dallas, Texas 75251
(214) 887-9600
jaime.ruivo@messinachemicals.com

M-I SWACO
5950 North Course Drive
Houston, Texas 77072
(713) 739-0222
lhofmann@slb.com

Montello Inc.
6106 East 32nd Place, Suite 100
Tulsa, Oklahoma 74135-5495
(800) 331-4628
leow@montelloinc.com

Newpark Drilling Fluids
21920 Merchants Way
Katy, TX 77449
(281) 754-8798
egurghigian@newpark.com

National Oilwell Varco
700 Conroe Park North Dr.
Conroe, Texas 77303
john.sherman@nov.com

Oleon N.V.
Vaartstraat 130
2520 Oelegem
Belgium
(32) 3 4706272
Michel.janssen@oleon.com

PQ Corp.
P.O. Box 840
Valley Forge, Pennsylvania 19482
(610) 651-4200

Prime Eco Group Inc.
2933 Hwy 60 South
Wharton, Texas 77488
(979) 531-1100
guzmanf@primeecogroup.com

PT Indobent Wijaya Mineral
Desa Punung
Pacitan, Propinsi Jawa Timur, Indonesia
62 81 330886381

Q'Max Solutions Inc.
1700, 407 – 2nd Street SW
Calgary, Alberta
(403) 269-2242
cibeziako@qmaxsolutions.com

Quaron N.V.
Industrieweg 27
1521NE Wormerveer
The Netherlands
(31) 75 6474500
jbouleij@quaron.com

Setac
5905 Johnston Street, Suite E
Lafayette, Louisiana 70503-5466
(337) 988-2236
setac@setac.com

Special Products & Mfg. Inc.
2625 Discovery Blvd
Rockwall, Texas 75032
(972) 771-8851

Strata Control Services Inc.
1811 West Mill Street
Crowley, Louisiana 70527-0272
(337) 785-0000
stratinc@bellsouth.net

Sun Drilling Products Corp.
503 Main Street
Belle Chasse, Louisiana 70037
(504) 393-2778
ronc@sundrilling.com

TBC-Brinadd
4800 San Felipe
Houston, Texas 77056
(713) 877-2758
ktresco@tbc-brinadd.com

TETRA Technologies Inc.
24955 I-45 North
The Woodlands, Texas 77380
(281) 367-1983

Turbo-Chem International Inc.
P.O. Box 60383
Lafayette, Louisiana 70596
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BACTERICIDES

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
BAKER HUGHES DRILLING FLUIDS											
MIL-BIO	Glutaraldehyde bactericide	•	•	•	•			0.1-.03%	Y		
MIL-BIO NS	Broad spectrum biocide for North Sea	•	•	•	•			0.1-.03%	Gold		
X-CIDE SERIES	Biocide series	•	•	•	•			varies			
BAROID FLUID SERVICES											
ALDACIDE-G	Biocide-Glutaraldehyde solution	•	•	•	•			0.2-0.5	Y		Y
STARCIDE	Microbiocide solution	•	•	•	•			0.3-0.5	Y		
STARCIDE-P	Microbiocide	•	•	•	•			0.05-0.25			Y
CHEMTOTAL											
CHEMCIDE-I	Glutaraldehyde	•	•	•	•	•		0.2-0.5	Y	N	Y
LAMBERTI SPA											
CARBOSAN EF	Triazine based, general purpose	•	•	•	•			.01-2			
CARBOSAN 135/TR	Triazine based, concentrated	•	•	•	•			.01-2			
M-I SWACO											
M-I CIDE	Non-U.S. Biocide	•	•	•	•			1.0-3.0	N	N	
SAFE-CIDE	Non-U.S. Biocide	•	•	•	•			0.1-0.5	Y	N	
NOV FLUIDCONTROL											
MYACIDE 25GA	Bacteriacide	•	•	•	•			0.05			Y
X-Cide 102	Liquid glutaraldehyde based bactericide	•	•	•	•			.005			Y
X-Cide 207	Granular chloromethylisothlazolone / methyl isothiazolone microbiocide	•	•	•	•			0.0175			Y

COMPLETION FLUIDS, CLEAR FLUIDS, BRINES

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
ADM EVOLUTION CHEMICALS											
OPTIXAN D	Dispersed Xathan gum biopolymer	•	•	•	•			0.25-2.0			Y
OPTIXAN DT	Clarified Dispersed Xathan gum biopolymer	•	•	•	•			0.25-2.0			Y
OPTIXAN	Xanthan Gum biopolymer	•	•	•	•			0.25-2.0			Y
OPTIXAN FG	Xanthan Gum biopolymer	•	•	•	•			0.25-2.0			Y
BAKER HUGHES DRILLING FLUIDS											
AMMONIUM CHLORIDE	NH_4Cl - ammonium chloride			•	•			8.4-9.5 lb/gal	E	Y	
HYCAL I	Calcium chloride solution to 11.6 ppg			•					E	Y	
HYCAL II	Calcium chloride/ bromide sol. to 15.1 ppg			•					E	Y	
HYCAL II SB	Calcium bromide solution to 15.3 ppg			•					E	Y	
HYCAL III	Calcium chloride/calcium bromide/ zinc-bromide solution to 19.2 ppg			•					B (Zn)		
HYCAL III SB	Calcium bromide/zinc bromide solution to 19.2 ppg			•					B (Zn)		
NOCAL I	Sodium chloride solution to 10.0 ppg			•					E	Y	
NOCAL II	Sodium chloride/bromide sol. to 12.8 ppg			•					E	Y	
NOCAL II SB	Sodium bromide solution to 12.8 ppg			•					E	Y	
NOCAL BR FRAC BRINE	Sodium bromide solution to 12.5 ppg			•					E	Y	
NOCAL K	Potassium chloride solution to 9.7 ppg			•					E	Y	
POTASSIUM FORMATE	Potassium formate brines to 13.3 ppg			•					E	Y	
SODIUM FORMATE	Sodium formate brines to 11.0 ppg			•					E	Y	
ULTRA SS DKD	inhibit salt agglomeration in saturated fluid with 110 and 220 ppb excess salt	•	•	•	•			5%			
BAROID FLUID SERVICES											
BARABRINE DEFOAM	Brine defoamer	•	•	•				0.05 -0.25			Y
BARABRINE SI	Scale inhibitor for clear brines	•	•	•	•			0.025-0.05			
BARABUF	pH Buffer	•	•	•	•			0.1-2.0	Y	Y	Y
BARACOR 100	Film-forming brine corrosion inhibitor	•	•	•	•			1%	Y		Y
BARACOR 450	HT corr. inhibitor for >2% zinc brines			•	•			0.2-0.4%	Y		Y
BARACOR 700E	Corrosion inhibitor for monovalent brines	•	•	•	•			0.5-2.0	Y		Y
BARAKLEAN	Degreaser and oil mud remover							As needed			Y
BARAKLEAN DUAL	Wellbore cleaner for displacement								Y		
BARAKLEAN FL	Wellbore cleaner for displacement							5% in H20			Y
BARAKLEAN FL PLUS	Wellbore cleaner for displacement							5% in H20	Y		
BARAKLEAN NS PLUS	Wellbore cleaner for displacement							5% in H20	Y		
BARAKLEAN GOLD	Wellbore cleaner for displacement							5% in H20	Y		
BARAPLUG 20, 50, 6/300	Sized sodium chloride	•	•	•				10-200	Y	Y	Y
BARARESIN	Sized oil soluble bridging particles			•	•			5.0-20.0			
BARARESIN-VIS	Oil mud viscosifier					•	•	3.0-20.0			Y
BARASCRUB	Terpene derived well cleaner	•	•	•	•	•		As needed			Y
BARASORB	Oil-adsorbant for brine reclamation							As needed	Y		
BARAVIS	HEC for brine viscosification	•	•	•	•			1-3	Y	Y	Y
BARAZAN	Xanthan gum	•	•	•	•			0.1-2.0	Y	Y	Y
BARAZAN D	Dispersion enhanced xanthan gum	•	•	•	•			0.1-2.0	Y	Y	Y
BARAZAN D PLUS	Dispersion enhanced xanthan	•	•	•	•			0.1-2.0	Y	Y	Y
BARAZAN L	Xanthan gum in liquid dispersion form	•	•	•	•			0.5-4.0	Y		Y
BROMI-VIS	HEC--liquid form for brine viscosification			•	•			5.0-20.0			Y
FLO-CLEAN MD	Flocculant for calcium brines							1-3 vol%			
FLO-CLEAN Z	Flocculant for zinc brines							1-3 vol%			
NO BLOK C	Emulsion preventor for non-zinc brines							0.1-1 vol%			Y
NO BLOK Z	Emulsion preventor for zinc brines							0.1-1 vol%			
OXYGON	Oxygen scavenger							0.1-0.2	Y		Y
DRILLING SPECIALTIES CO.											
CLARIZAN BIOPOLYMER	High viscosity clarified biopolymer	•	•	•	•			0.25-2.0	E	Y	Y
DRILLZAN D BIOPOLYMER	Economical high viscosity biopolymer	•	•	•	•			0.25-2.0		Y	Y
DRISPAC PLUS REGULAR	Dispersable HV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC PLUS SUPERLO	Dispersable LV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC REGULAR POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC SUPERLO POLYMER	Low viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRILLPAC HV POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRILLPAC LV POLYMER	Low viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
FLOWZAN BIOPOLYMER	High viscosity biopolymer	•	•	•	•			0.25-2.0		Y	Y
GREEN BASE GUAR CM-36 ADDITIVE	Continuous mix liquid guar		•	•				2.0-5.0		Y	Y
GREENBASE DRISPAC POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.5-4.0		Y	Y
GREENBASE FLOWZAN POLYMER	High viscosity biopolymer	•	•	•	•			0.5-4.0		Y	Y
GREENBASE LIQUID HEC POLYMER	High viscosity pure hydroxyethyl cellulosic polymer	•	•	•	•			0.5-5.0		Y	Y
GUAR LIQUID CM ADDITIVE	Continuous mix liquid guar		•	•				2.0-5.0		Y	N
LIQUID HE 150 POLYMER	Brine viscosifier in a mineral oil carrier fluid	•	•	•	•			2.0-10.0		Y	N
HE 150 POLYMER	Brine viscosifier dry powder	•	•	•	•			1.0-5.0		Y	Y
GREENBASE HE 150 POLYMER	Brine viscosifier in a glycol carrier fluid	•	•	•	•			2.0-10		Y	Y
HE 300 POLYMER	High temp. brine viscosifier	•	•	•	•			2.0-5.0	E	Y	Y
HE 400 POLYMER	High temp. brine viscosifier	•	•	•	•			2.0-5.0		Y	Y
LIQUID DRISPAC POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.5-5.0		Y	N
LIQUID FLOWZAN BIOPOLYMER	High viscosity biopolymer	•	•	•	•			0.5-4.0		Y	N
LIQUID HEC POLYMER	High viscosity pure hydroxyethyl cellulosic polymer	•	•	•	•			0.5-5.0		Y	N
IMPACT FLUID SOLUTIONS											
STAR HIB L	Shale control/clay inhibitor - low chlorides	•	•	•	•			2%-5%	Y		Y
STAR HIB S	Shale control/clay inhibitor - low chlorides	•	•	•	•			2%-5%	Y		Y
STAR HIB PLUS	Shale control/clay inhibitor - low conductivity	•	•	•	•			2%-5%	Y		Y
STAR HIB SF	Shale control/clay inhibitor - chloride free	•	•	•	•			2%-5%	Y		Y
FLC 2000	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
STAR SHIELD	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
LAMBERTI SPA											
ALBISOL AT	Effective cleaner/spacer	•	•	•	•	•	•	2-10%			Y
ALBISOL DM	Effective washer/spacer	•	•	•	•	•	•	2-10%			
ALBISOL E	Environmental washer/spacer	•	•	•	•	•	•	2-10%			Y
ALBISOL F10	Environmental friendly washer / spacer	•	•	•	•	•	•	2-10%			Y
ALBISOL K100	Cleaner/Spacer for grease residues	•	•	•	•	•	•	2-10%			
ALBISOL MCS	Effective washer/spacer	•	•	•	•	•	•	2-10%			
ALBISOL OE	Solvent based pipe cleaner					•		2-10%			
BIOLAM XG	Xanthan derivative polymeric viscosifier	•	•	•	•			0.25-2		Y	Y
BIOLAM XG LS	Liquid xanthan viscosifier	•	•	•	•			0.25-2			Y
CARBOSAN EF	Triazine based, general purpose biocide	•	•	•	•			0.01-2			
CARBOSAN 135/TR	Triazine based, concentrated biocide	•	•	•	•			0.01-2			
INICOR B/N	Water soluble corrosion inhibitor	•	•	•	•			1-4			
INICOR W303	Amine based, water soluble	•	•	•	•			0.1- 3			
INICOR W481	Water soluble CO for brine	•	•	•	•			0.01-0.3			
INICOR W882	Corrosion inhibitor Organo-phosphate	•	•	•	•			0.1- 3	Y		Y
INICOR 220	Corrosion inhibitor for brines	•	•	•	•			0.1- 3			
LAMOX OS	Oil Soluble H_2S scavenger	•	•	•	•			.1-.2			
LAMOX TR	Organic, water soluble H_2S scavenger	•	•	•	•			.1-.2			
LAMOX NA	Oxygen scavengers for sodium and potassium brines	•	•	•	•			.1-.2			
LUBRICANT EHB	Environmental friendly lubricant for heavy brines	•	•	•	•			0.5- 5			Y
LUBRICANT CBR 600	Environmentally friendly brine soluble	•	•	•	•			0.5- 5	Y		Y
M-I SWACO											
BAR-NONE	Barium Scale remover			•	•						
DOWFROST MI	Insulating packer fluid for deepwater			•	•			As needed			
ISOTHERM NT	Oil-base insulating packer fluids					•	•				Y
SAFE-BREAK 611	Non-emulsifier			•				0.1-2%	N	N	
SAFE-BREAK CBF	Emulsion preventer for brine			•				0.1-1.0%	N	N	
SAFE-BREAK ZINC	Emulsion preventer for zinc bromide brine			•				0.1-1.0%	N	N	
NEWPARK DRILLING FLUIDS											
NEWARMOR	Film-forming amine	•	•	•	•			5-15 gal/100bbl			
NOV FLUIDCONTROL											
AMONIUM CHLORIDE	Salt			•	•			As needed			
EGMBE	Displacement chemical (solvent)					•					
CALCIUM BROMIDE	Salt			•	•			As needed			
CALCIUM CHLORIDE	Salt			•	•			As needed			
COR-CHEK AFW	Corrosion inhibitor filming amine			•	•			30 gal/100 bbl			
COR-CHEK HT	Corrosion inhibitor HT/heavy brine			•	•			55 gal/400			
COR-CHEK 02	Oxygen scavenger			•	•						
FOAM-OUT	Premium silicone based defoamer			•	•			0.25/100 bbl			
FOAM-OUT B	Defoamer for brines										
HEC-LINK 11	Crosslinkable HEC for LCM for non zinc brine										
HEC-LINK 14	Crosslinkable HEC for LCM in zinc brine										
HEC-VIS	Granular HEC viscosifier										
HEC-VIS L	Liquic HEC viscosifier			•	•			0.25-4			
Magnesium Oxide	pH buffer for freshwater and brines							0.2			
MYACIDE 25GA	Bacteriacide			•	•			5 gal/100 bbl			
NOV CARB C	Coarse ground and sized calcium carbonate			•	•			As needed			
NOV CARB F	Medium ground and sized calcium carbonate			•	•			As needed			
NOV CARB M	Fine ground and sized calcium carbonate			•	•			As needed			
NOV XAN D	Dispersable xanthan powder			•	•			0.25-4			
PERM-CON	Surface tension reducing completion brine surfactant										
POTASSIUM CHLORIDE	Salt			•	•			As needed			
SODIUM BROMIDE	Salt			•	•			As needed			
SODIUM CHLORIDE	Salt			•	•			As needed			
TRU-FLUSH	Well wash for seawater and high density brines containing divalents			•	•			55 gal/100 bbl			
TRU-FLUSH A	Well wash without breaker. Stable in hydrochloric acid containing formulations										
TRU-FLUSH ECO	Well wash in turpene carrier										

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
OLEON N.V.											
RADIAGREEN CLO	Stimulation additive & mud cake breaker					•	•	As needed			
RADIAGREEN CLW	Cased hole cleaner	•	•	•		•	•	As needed			
RADIAGREEN EME SALT	Lubricant for heavy brines	•	•	•				0.5-3%	Y	N	Y
RADIAGREEN RA	Reservoir enhancer	•	•	•	•			0.5-1%	Y	N	
TURBO-CHEM INTERNATIONAL											
EZ SQUEEZE	High solids, high fluid loss squeeze	•	•	•	•	•	•	32-100 ppb			Y
PREMIUM SEAL	Cellulose fiber (fine and coarse)	•	•	•	•	•	•	4-6			Y
SWELLCM	Gelled, swelling, sealing agent	•	•	•	•	•	•	10 ppb			Y
SWELLCM ACTIVATOR	Crystals used to adjust pH of water when mixing SwellCM	•	•	•	•			2 ppb			Y
CORROSION INHIBITORS											
BAKER HUGHES DRILLING FLUIDS											
BRINE-PAC 250	Corrosion inhibitor for solids-free fluids			•	•			5-10gal/100			
BRINE-PAC XTS	Corrosion Inhibitor for solids-free fluids			•	•			12 gal/100 bbl			
MIL-GARD	Corrosion Inhibitor	•	•	•	•	•		1-3 ppb			
MIL-GARD FE	H_2S extractor	•	•	•	•	•	•	5.5 gal/100	Y		
MIL-GARD L	Zinc chelated sulfide scavenger	•	•	•	•	•	•	5.5 gal/100			
MIL-GARD XPR	Hydrogen sulphide scavenger for NS use	•	•	•	•	•	•	Varies	Gold		
NOXYCOR	Corrosion inhibitor for water based and air/mist/foam drilling applications	•	•	•	•			Varies			
NOXYGEN L	Liquid oxygen scavenger	•	•	•	•			75 to 125 ppm			
NOXYGEN NA	Liq. oxygen scavenger - sodium bisulfite	•	•	•	•			250 ppm	Y	Y	
NOXYGEN XT	Organic oxygen scavenger			•	•			As needed			
OHR AC	Acid corrosion control for the MICROWASH System							0.75-1%			
OHR ACE	Acid corrosion control for MICRO-WASH - enviro. safe							0.5-1%	Y		
BAROID FLUID SERVICES											
BARABRINE SI	Scale inhibitor for clear brines			•	•			.025-.05			
BARACOR 95	Corrosion inhibitor and CO_2 remover	•	•	•	•			0.25-2.0	Y		Y
BARACOR 100	Film-forming corrosion inhibitor			•	•			0.01	Y		Y
BARACOR 450	HT corr. inhibitor for >2% zinc brines			•	•			0.2-0.4%	Y		Y
BARACOR 700	Corrosion inhibitor for monovalent brines			•	•			0.5-1.5			Y
BARACOR 700E	Corrosion inhibitor for monovalent brines			•	•			0.5-2.0	Y		Y
BARAFILM	Filming amine			•	•			1:6 W/O			Y
BARASCAV-D	Powdered oxygen scavenger	•	•	•	•			0.1-0.5	Y	Y	Y
BARASCAV-L	Liquid oxygen scavenger	•	•	•	•			0.1-0.5	Y	Y	Y
NO-SULF	Zinc compound for sulfide scavenging	•	•	•	•	•	•	1.0-4.0			Y
OXYGON	Oxygen scavenger			•	•			0.1	Y		
SOURSCAV	Hydrogen sulfide scavenger	•	•	•	•			1-4	Y		
CRODA											
PRIPOL 1017	Dimer fatty acid					•	•	0.05-1.0%			
PRIPOL 1029	Dimer fatty acid					•	•	0.05-1.0%			
PRIPOL 1040	Trimer fatty acid					•	•	0.05-1.0%			
PRIPOL 1045	Dimer/Trimer fatty acid					•	•	0.05-1.0%			
Crodafos 04A	Corrosion inhibitor for water-based systems	•	•		•			0.05-1.0%			
Crodafos T5A	Corrosion inhibitor for water-based systems	•	•		•			0.05-1.0%			
Multitrope 1214	Corrosion inhibitor for water-based systems	•	•		•			0.05-1.0%			
Crodazoline O	Corrosion inhibitor for water-based systems	•	•					0.05-1.0%			
Crodasinic O	Corrosion inhibitor for water-based systems	•	•					0.05-1.0%			
Pripol 1013	Dimer acid							0.05-1.0%			
Pripol 1022	Dimer acid							0.05-1.0%			
Pripol 1046	Dimer/trimer acid							0.05-1.0%			
LAMBERTI SPA											
ANTISCALE AC/1	Phosphonate-based scale inhibitor	•	•	•	•			10-1,000 ppm			
ANTISCALE AC/137	Mixed scale inhibitor	•	•	•	•			10-1,000 ppm			
ANTISCALE AC/58	Synthetic polymer based scale inhibitor	•	•	•	•			10-1,000 ppm			
INICOR B/N	Water soluble corrosion inhibitor	•	•	•	•			0.1- 3			
INICOR W303	Amine based, water soluble	•	•	•	•			0.1- 3			
INICOR MF/27	Oil soluble					•	•	0.1- 3			
INICOR W481	Environmentally friendly, water soluble	•	•	•	•			0.1- 3			Y
INICOR 220	Corrosion inhibitor for brines	•	•	•	•			0.1- 3			
INICOR W882	Corrosion inhibitor Organo-phosphate	•	•	•	•			0.1- 3	Y		Y
LAMOX OS	Oil Soluble H_2S scavenger	•	•	•	•			.1-.2			
LAMOX TR	Organic, water soluble H_2S scavenger	•	•	•	•			0.1-0.2			
LAMOX NA	Oxigen scavengers for sodium and potassium brines	•	•	•	•			0.1-.2			
M-I SWACO											
CONQOR 101	Water-dispersible amine for packers	•			•			3-4	N	N	
CONQOR 202B	Film-forming amine for drill string application	•	•	•	•			5-15 gal slugs	N	N	
CONQOR 303A	Brine-soluble filming amine			•				1-4	Y	N	Y
CONQOR 404	Organic inhibitor for all WBM	•	•	•	•			0.2-0.5	Y	N	
SULFATREAT DFS	H_2S scavenger	•	•	•	•	•	•	20.0			
OS-1L	Sulfite-base oxygen scavenger	•	•	•	•			0.1-0.5	Y	Y	
RE-PLEX	Anionic scavenger for DRILPLEX system	•						0.25-0.5			
SAFE-COR	Amine-base corrosion inhibitor				•			0.5-1.0%	Y	N	
SAFE-COR C	Modified corrosion inhibitor, amine-base for casing				•			0.25-0.5%	N	N	
SAFE-COR EN	Amine-base corrosion inhibitor				•			0.05-1.0%	N	N	
SAFE-COR HT	Inorganic thiocyanate-base corrosion inhibitor for high-temperature use				•	•		0.00036	N	N	
SAFE-SCAV CA	Organic oxygen scavenger for Ca-base brines				•			15.00%	N	N	
SAFE-SCAV HS	Organic H_2S scavenger				•			0.1	N	N	
SAFE-SCAV HSW	Organic H_2S scavenger w/ methanol				•			0.1	N	N	
SAFE-SCAV NA	Liquid bisulfate-base oxygen scavenger for Na and K brines				•			0.1	N	N	
SAFE-SCAVITE II	Calcium scale preventer				•			0.15-3	N	N	
SI-1000	Blended scale inhibitor	•	•	•	•			0.05	N	N	Y
SV-120	Cold climate H_2S scavenger				•			1-5	N	N	
NEWPARK DRILLING FLUIDS											
NEWARMOR	Film-forming amine	•	•	•	•			5-15 gal/100bbl			

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
NOV FLUIDCONTROL											
COR-CHEK AFM	Filming amine	•	•	•	•			30/100			Y
COR-CHEK OP	Premium organo-phosphorus corrosion inhibitor	•	•	•	•						
COR-CHEK HT	HT corrosion inhibitor	•	•	•	•			55/100			Y
COR-CHEK CA	Sodium erythorbate oxygen scavenger/ corrosion inhibitor	•	•	•	•						
COR-CHEK O2	Ammonium bisulfite oxygen scavenger/ corrosion inhibitor	•	•	•	•			0.02			Y
DEFOAMERS											
ADM EVOLUTION CHEMICALS											
ADM 2100	Low visc "Green" defoamer, emulsifier, lubricity enhancer, wetting agent	•	•	•	•	•	•	0.05-0.25			Y
AES DRILLING FLUIDS											
AES DEFOAM A	Alcohol based liquid defoamer for water based fluids	•	•	•	•						
DEFOAMEX SB	Silicone based liquid defoamer for water based fluids	•	•	•	•						
BAKER HUGHES DRILLING FLUIDS											
DEFOAMER	Defoaming agent for completion fluids			•	•			As needed			
LD-8	Non-hydrocarbon-based defoamer for water-based fluids	•	•	•	•			As needed			Y
LD-8e	North Sea compliant defoamer for water-based fluids	•	•	•	•			As needed	Y		Y
LD-9	Defoamer for both fresh & saltwater drilling fluids	•	•	•	•			As needed			
LD-10	Silicone based defoamer for fresh and saltwater drilling fluids	•	•	•	•			As needed			
W.O. DEFOAM	Alcohol-based compound for defoaming water-based fluids	•	•	•	•			0.1 gal/bbl			Y
BAROID FLUID SERVICES											
BARA-DEFOAM 1	Alcohol and fatty acid blend	•	•		•			0.05-0.2			Y
BARA-DEFOAM HP	Polypropylene glycol	•	•		•			0.05-0.3			Y
BARA-DEFOAM W300	Alcohol and fatty acid blend	•	•		•			0.05-0.2			Y
BARABRINE DEFOAM	Non-ionic surfactant blend for brines			•	•			0.05-0.2			Y
FOAM ZAPPER	Blend of renewable resource products	•	•		•			0.05-0.2			Y
CRODA											
SYNPERONIC PE/L121	Water soluble defoamer		•	•	•			0.01-2.55%			
Synperonic LF/26	Defoamer	•	•		•			0.01-2.55%			
Synperonic PE/L61	Defoamer	•	•		•			0.01-2.55%			
Synperonic PE/L101	Defoamer	•	•		•			0.01-2.55%			
Synperonic PE/25R2	Defoamer	•	•		•			0.01-2.55%			
Synperonic T/701	Defoamer	•	•		•			0.01-2.55%			
Synperonic NCA810	Defoamer	•	•		•			0.01-2.55%			
DRILLING SPECIALTIES CO.											
DSCO-DEFOAM	Synthetic defoamer	•	•	•	•			0.1-0.2		Y	Y
LAMBERTI SPA											
DEFOMEX	General purpose silicone based defoamer	•	•	•	•			0.05-0.5			
DEFOMEX DR5	Highly concentrate general purpose defoamer	•	•	•	•			0.05-0.5			
DEFOMEX G9	Environmentally friendly for North Sea	•	•	•	•			0.05-0.5			Y
DEFOMEX TM	Defoamer in powder form	•	•	•	•			0.05-0.5			
DEFOMEX 42	Long chain hydroxy compound	•	•	•	•			0.05-0.5			
DEFOMEX 200	Non ionic defoamer	•	•	•	•			0.05-0.5			
DEFOMEX 610/L	High M.W. alcohol based	•	•	•	•			0.05-0.5			
DEFOMEX 620	Surfactant based, highly effective	•	•	•	•			0.05-0.5			
M-I SWACO											
DEFOAM-A	Alcohol-base defoamer	•	•	•	•			0.1-0.5		N	N
DEFOAM-X	Liquid low toxicity defoamer	•	•	•	•			0.1-0.5	Y	N	N
DEFOAM NA	All-purpose defoamer	•	•	•	•						
DI-ANTIFOAM	Antifoaming agent for the DIPRO system			•				0.3 gal/bbl			
NULLFOAM	Defoamer			•				0.3 gal/bbl			
SAFE-DFOAM	Blended alcohol defoaming agent		•	•	•			0.08-0.16		N	N
NEWPARK DRILLING FLUIDS											
NOFOAM A	Alcohol-based	•	•	•	•	•	•				Y
NOFOAM X	Multifuntional	•	•	•	•						Y
NOV FLUIDCONTROL											
ALUMINUM STEARATE	Inorganic salt based drilling fluid defoamer	•	•	•	•			0.05			
FOAM-OUT	Premium defoamer										
FOAM-OUT A	Alcohol based mud defoamer										
FOAM-OUT B	Defoamer for brines										
FOAM-OUT S	Silicone based mud defoamer										
FOAM-OUT G	Glycol based mud defoamer										
TURBO-CHEM INTERNATIONAL											
TURBO-DEFOAM	Defoamer	•	•	•	•						Y
DRILL-IN FLUID											
ADM EVOLUTION CHEMICALS											
OPTIXAN D	Dispersed Xathan gum biopolymer	•	•	•	•			0.25-2.0			Y
OPTIXAN DT	Clarified Dispersed Xathan gum biopolymer	•	•	•	•			0.25-2.0			Y
OPTIXAN	Xanthan Gum biopolymer	•	•	•	•			0.25-2.0			Y
OPTIXAN FG	Xanthan Gum biopolymer	•	•	•	•			0.25-2.0			Y
BAKER HUGHES DRILLING FLUIDS											
GeoPACK	Oil based gravel pack carrier system						•				
MICRO-WASH	Open hole reservoir restoration										
MPA-50	Micro-prime activator, 50%							Varies			
MUDZYME S	Enzymes to degrade starch in filter cakes							0.4 gal/bbl			
MUDZYME X	Enzymes to degrade xanthan gum in filter cakes							2 gal/bbl			
OMNI-FLOW DIF	Invert Emulsion Reservoir Drill-in fluid										
PERFFLOW LD	Low density drill-In fluid				•	•					
PERFFLOW CM	Drill-in fluid - customized bridging										
PERFFLOW DIF	Drill-in fluid								Y		Y
PLUG-LIFT	Multi-stage composite frac plug drill-out system				•	•					
BAROID FLUID SERVICES											
ALDACIDE-G	Glutaraldehyde solution	•	•	•	•			0.2-0.5	Y		Y
BARABLOK	Powdered gilsonite, wallcake enhancer	•	•	•	•	•	•	5.0-35.0	Y	Y	Y
BARABLOK 400	Hi-temp powdered gilsonite	•	•	•	•	•	•	5.0-35.0			Y
BARABUF	pH buffer	•	•	•	•			0.1-2.0	Y	Y	Y

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BARACARB 5, 25, 50, 150, 400, 600, 1200	Sized acid-soluble marble	•	•	•	•	•	•	5.0-60.0	Y	Y	Y
BARACARB DF 5, 25, 50, 150, 600	Sized acid-soluble marble	•	•	•	•	•	•	5.0-60.0	Y	Y	Y
BARACTIVE	Polar activator for all-oil systems					•	•	4.0-7.0	Y	Y	Y
BARA-DEFOAM HP	Polypropylene glycol	•	•		•			0.05-0.3			Y
BARADRIL-N	DRIL-N system, water based			•	•			System			Y
BARAPLUG 20, 50, 6/300	Sized salt	•		•				10-200	Y	Y	Y
BRINEDRIL-N	DRIL-N system, brine based			•	•			System			
COREDRIL-N	DRIL-N system, 100% oil/synthetic					•	•	System			
DRIL-N STIM	RDF containing additive to improve reservoir producibility		•	•							
DURATONE HT	Oil mud filtration control additive					•	•	2.0-20.0			Y
DURATONE E	Oil mud filtration control additive					•	•	2.0-20.0	Y		Y
EZ-CORE	Fatty acid passive emulsifier for all-oil					•	•	1.0-4.0	Y		
MAXDRIL-N	DRIL-N system, mixed metal silicate				•			System			
N-DRIL HT PLUS	Modified starch	•	•	•	•			2.0-6.0	Y	Y	Y
N-PLEX	Activator for N-SQUEEZE	•	•	•	•	•	•	4	Y		
N-SEAL	Inorganic LCM	•	•	•	•	•	•	5.0-30.0			Y
N-SQUEEZE	Lost circulation material	•	•	•	•	•	•	8.0-40.0	Y	Y	Y
N-VIS	Biopolymer	•	•	•	•			0.5-2.0			Y
N-VIS HI	Mixed metal silicates		•					1	Y		
N-VIS L	Liquid xanthan dispersion	•	•	•	•			0.25-3.0			Y
N-VIS O	Organophilic clay viscosifier					•	•	1.0-6.0			
N-VIS P PLUS	Biopolymer/modified starch	•	•	•	•			2.0-8.0	Y	Y	
QUICKDRIL-N	DRIL-N system, modified polymer with LSRV			•	•			System			
SHEARDRIL-N	DRIL-N system, clay-free with modified polymers			•	•			System			
SOLUDRIL-N	DRIL-N system, polymer/sized salt			•				System			
DRILLING SPECIALTIES CO.											
CLARIZAN BIOPOLYMER	High viscosity clarified biopolymer	•	•	•	•			0.25-2.0	E	Y	Y
DRILLZAN D BIOPOLYMER	Economical high viscosity biopolymer	•	•	•	•			0.25-2.0		Y	Y
DRISPAC PLUS REGULAR	Dispersable HV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC PLUS SUPERLO	Dispersable LV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC REGULAR POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC SUPERLO POLYMER	Low viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRILLPAC HV POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRILLPAC LV POLYMER	Low viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
FLOWZAN BIOPOLYMER	High viscosity biopolymer	•	•	•	•			0.25-2.0		Y	Y
GREENBASE DRISPAC POLYMER	Liquid high viscosity polyanionic cellulose	•	•	•	•			0.5-4.0		Y	Y
GREENBASE FLOWZAN POLYMER	Liquid High viscosity biopolymer	•	•	•	•			0.5-4.0		Y	Y
GREENBASE HEC POLYMER	Liquid High Viscosity hydroxyethyl cellulose	•	•	•	•			0.5-5.0		Y	Y
LIQUID HE 150 POLYMER	Brine viscosifier in a mineral oil carrier fluid	•	•	•	•			2.0-10.0		Y	N
GREENBASE HE 150 POLYMER	Brine viscosifier in a glycol carrier fluid	•	•	•	•			3.0-15.0		Y	Y
HE 150 POLYMER	Brine viscosifier dry powder	•	•	•	•			1.0-5.0		Y	Y
HE 300 POLYMER	High temp. brine viscosifier	•	•	•	•			2.0-5.0	E	Y	Y
HE 400 POLYMER	High temp. brine viscosifier	•	•	•	•			2.0-5.0		Y	Y
LIQUID DRISPAC POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.5-4.0		Y	N
LIQUID FLOWZAN BIOPOLYMER	High viscosity biopolymer	•	•	•	•			0.5-4.0		Y	N
LIQUID HEC POLYMER	High viscosity pure hydroxyethyl cellulosic polymer	•	•	•	•			0.5-5.0		Y	N
IMPACT FLUID SOLUTIONS											
STAR HIB L	Shale control/clay inhibitor - low chlorides			•	•			2%-5%	Y		Y
STAR HIB S	Shale control/clay inhibitor - low chlorides							2%-5%	Y		Y
STAR HIB PLUS	Shale control/clay inhibitor - low conductivity							2%-5%	Y		Y
STAR HIB SF	Shale control/clay inhibitor - chloride free			•	•			2%-5%	Y		Y
FLC 2000	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
STAR SHIELD	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
STAR FLH	Wellbore stabilization/invasion control - OBM					•	•	4.0-6.0	Y		
LAMBERTI SPA											
LAMPAC CHL	Premium grade, low viscosity, purified PAC	•	•	•	•			.2-2		Y	Y
LAMPAC CHR	High viscosity, premium grade, purified PAC	•	•	•	•			.2-2		Y	Y
LAMPAC EXLO	Extremely low viscosity PAC	•	•	•	•			.2-3		Y	Y
LAMPAC LOVIS	Low viscosity purified PAC, according to API/ISO	•	•	•	•			.2-2		Y	Y
LAMPAC REGULAR	High viscosity, purified PAC, according to API/ISO	•	•	•	•			.2-2		Y	Y
LUBRICANT EHB	Environmental friendly lubricant for heavy brines	•	•	•	•			1-3%			
LUBRICANT CBR 600	Environmentally friendly brine soluble lubricant	•	•	•	•			1-3%	Y		Y
FRONLUBE 100	Top range lubricant for salty environment	•	•	•	•	•	•	1-3%			
FRONLUBE 200	Top range, ester based lubricant	•	•	•	•	•	•	1-3%			
HYBSTAR CFA	Chloride free neutralized polyamine	•	•	•	•			1-3%	Y		Y
HYBSTAR HS	Cost effective, amine derivative based	•	•	•	•			1-3%	Y		Y
PAG 102	Polyglycol shale inhibitor (low cloud point)	•	•	•	•			0.03			Y
PAG 211	Polyglycol shale inhibitor (Medium Cloud Point)	•	•	•	•			0.03			Y
INICOR B/N	Water soluble corrosion inhibitor	•	•	•	•			0.1- 3			
CARBOSAN EF	Triazine based, general purpose	•	•	•	•			.01-2			
M-I SWACO											
BREAKDOWN	Chelant-based clean-up system							System			
BREAKDOWN 7	Neutral to slightly basic chelant clean-up system							System			
BREAKDOWN HD	High density chelant based clean-up system							System			
BREAKFREE	Enzyme-based clean-up system							System			
D-SOLVER	Chelant		•			•	•	To 75 vol%			
D-SOLVER 7	Neutral to slightly basic chelant			•		•	•	To 80 vol%			
D-SOLVER D	Dry Chelant		•					10-25% wt			Y
D-SOLVER EXTRA	Chelant		•	•	•			10-30% wt			
D-SOLVER HD	High density Chelant		•			•	•	20-35%			Y
D-SOLVER PLUS	Chelant/acid blend		•			•	•	To 85 vol%			
D-SPERSE	Surfactant for BREAKFREE and BREAKDOWN systems		•	•				0.25-1 vol%			
D-STROYER	Internal oxidizer breaker product			•	•			0.5-2.0			
D-STRUCTOR	Organic acid precursor used in FAZ-AWAY or FAZE-OUT breaker systems to remove FAZEPRO filter cake					•	•	>30 vol%			
DI-BALANCE	Viscosifier for the DIPRO system			•				0.25-2			
DI-BOOST	Secondary viscosifier for the DIPRO system			•				0.03-0.06 gal/bbl			
DI-INHIB	Shale inhibitor for the DIPRO system			•				3% by vol			
DI-LOK	Rheo-Mod for DI-PRO LD system			•							
DI-PLEX	Low-end rheology maintainer for DIPRO LD systems			•							
DIPRO	High-density, low-solids, divalent brine RDF system			•				System			
DIPRO LD	Low-density, DIPRO system			•				System			
DI-TROL	Filtration control agent for the DIPRO system			•				8.0			
DRILPLEX	Diverse Mixed Metal Oxide system		•		•			System			
DRILPLEX	MMO viscosifier		•		•			1-3			Y
DUAL-FLO	FCA for the FLOPRO NT system		•	•	•			4-6	N	N	Y
DUAL-FLO HT	FCA for high-temperature applications		•	•	•			2-7			
FAZE-AWAY	Invert-emulsion breaker system for FAZEPRO system					•	•	System			Y
FAZEBREAK	Delayed clean-up system for FAZEPRO system							System			
FAZE-OUT	Delayed breaker system for FAZEPRO system				•			System			Y
FAZE-MUL	Emulsifier for FAZEPRO System					•	•	8-12	N	N	
FAZE-MUL CW	Emulsifier for FAZEPRO System in cold weather					•	•	8-12			
FAZEPRO	Reversible invert emulsion fluid system					•	•	System			
FAZE-WET	Wetting agent for FAZEPRO System					•	•	2-4	N	N	
FAZE-WET CW	Wetting agent for FAZEPRO System in cold weather					•	•	2-4			
FLO-PLEX	Fluid loss additive for DRILPLEX System	•		•				2-6	Y	N	Y
FLOPRO NT	Minimal solids, non-damaging WB RDF system			•	•			System			
FLOPRO SF	Solids-free non-damaging WB RDF system			•	•			System			
FLO-THRU	Minimal solids, non-damaging WB RDF system			•	•			System			Y
FLO-THRU SF	Solids-free non-damaging WB RDF system			•	•			System			Y
FLO-TROL	Modified starch derivative	•	•	•	•			2-4	Y	Y	Y
FLO-VIS L	Non-dispersible, clarified Xanthan gum			•				.25-.5 gal/bbl			
FLO-VIS NT	Non-dispersible, non-clarified Xanthan gum		•	•	•			.25-1.5			
FLO-VIS PLUS	Premium clarified Xanthan for FLOPRO NT systems	•	•	•	•			0.5-2.5	N	N	
FLO-WATE	Sized salt weighting agent for FLOPRO system			•				40-60	N	N	
K-52	Non-chloride potassium supplement for FLOPRO NT systems	•	•	•	•			1-5	N	N	Y
KLA-CURE	Hydration suppressant for FLOPRO NT systems		•	•	•			4-8	N	Y	Y
KLA-CURE II	Hydration suppressant with detergent		•	•	•			4-8	N	N	
KLA-GARD	Shale inhibitor and hydration suppressant for FLOPRO NT systems		•	•	•			4-8	N	Y	Y
KLA-GARD B	Salt-free KLA-GARD		•	•	•			4-8	N	N	Y
KLA-STOP	Liquid polyamine shale inhibitor		•	•	•			1-4 vol%			
LUBE-167	Low-toxicity lubricant for FLOPRO NT system	•	•	•	•			4-16	N	Y	Y
NOVAPRO	Synthetic olefin-base RDF system						•	System			
OPTITRAK 600	MDT tracer	•	•	•	•			1,000 mg/l filtrate			
PARAPRO	Paraffin-base RDF system						•	System			
POWERVIS	Biopolymer viscosifier		•		•			0.875-1.25			Y
POWERVIS L	Liquid biopolymer viscosifier		•		•						Y
SAFE-BREAK S	Polymer breaker			•	•			0.002-0.01		N	N
SAFE-BREAK MP	Internal breaker used in polymer-base fluids		•	•	•			0.5-4.0			Y
SAFE-CARB	Ground marble weighting/bridging agent	•	•	•	•	•	•	10-50		Y	N
VERSA-OUT/NOVA-OUT	Breaker system for VERSAPRO and NOVAPRO					•	•	System			Y
VERSA-WAY/NOVA-WAY	Invert-emulsion breaker system for VERSAPRO and NOVAPRO					•	•	System			Y
VERSAPRO	Oil-base RDF system					•		System			
VERSAPRO LS	Low-solids oil-base RDF system							System			
WELLZYME A	Enzyme breaker with biocide for water-base RDF fluids			•	•			2-5%	N	N	
WELLZYME III	Enzyme breaker without biocide for water-base RDF fluids			•	•			2-10%	N	N	
OLEON N.V.											
RADIAGREEN EBO	General-purpose lubricant & ROP enhancer	•	•	•	•	•	•	4-6%	Y	N	Y
RADIAGREEN EME-SALT	Lubricant for heavy brines	•	•	•				0.5-3%	Y	N	Y
RADIAGREEN RA	Reservoir enhancer	•	•	•	•			0.5-1%	Y	N	
RADIAGREEN SL	Lubricant for pH system >10	•	•	•				2-5%	Y	N	Y
EMULSIFIERS											
ADM EVOLUTION CHEMICALS											
ADM 2100	Low viscosity "Green" emulsifier, lubricity enhancer, wetting agent					•	•	0.25-2			Y
ADM 750	"Green" surfactant, lubricity enhancer, wetting agent, secondary emulsifier	•	•	•	•			0.25-2			Y
ADM 3100	Low viscosity "Green" surfactant/lubricity enhancer, wetting agent, secondary emulsifier	•	•	•	•			0.25-2			Y
AES DRILLING FLUIDS											
ABS MUL	Emulsifier package for diesel and synthetic based drilling fluids					•	•				
AES MUL	Emulsifier package for diesel based drilling fluids					•					
AES PRIMARY EMULSIFIER	Primary Emulsifier for diesel and synthetic based drilling fluids					•	•				
AES SECONDARY EMULSIFIER	Secondary Emulsifier for diesel and synthetic based drilling fluids					•	•				
AES WA II	Wetting agent for diesel and synthetic based drilling fluids					•	•				
AES WA	Wetting agent for diesel based drilling fluids					•					
ENERMUL	Emulsifier for ENERREACH system					•	•				

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
ENERMUL II	Emulsifier (secondary) for ENERREACH system					•	•				
ENERWET	Wetting agent for ENERREACH (oil, synthetic based)					•	•				
PUREMUL	Emulsifier package for PURESTAR fluid system						•				
BAKER HUGHES DRILLING FLUIDS											
CARBO-MUL HT	High-temperature emulsifier and wetting agent					•		2.9-23.8 L/m³	Y		
CARBO-MUL HT-N	High-temperature emulsifier and wetting agent for Norway					•		2.9-23.8 L/m³	Y		
CARBO-MUL LT	Low-temperature emulsifier and wetting agent					•		0.5-1.5 ppb			
CARBO-TEC	High-temperature anionic emulsifier					•		14.3-40.5 L/m³	Y		
CARBO-TEC LT	Low Temp. supplemental emulsifier						•	Up to 14.3 L/m³			
CARBO-TEC "S"	Supplemental emulsifier and viscosifier					•	•	Up to 14.3 L/m³	Y		
DELTA-MUL	High performance, CEFAS substitution-free emulsifier and wetting agent for the North Sea					•	•	0.12-1.5 gal/bbl	Y		
DELTA-MUL XS	High-temperature, CEFAS substitution-free emulsifier and wetting agent for the North Sea					•	•	0.5-1.5 gal/bbl			
ECCO-MUL E	Emulsifier for invert-emulsion systems					•		12-36 L/m³	Y		
ECCO-MUL R	Emulsifier for invert-emulsion systems					•		0.5-0.75gal/bbl	Y		
MAGMA-VERT	Emulsifier for MAGMA-TEQ extreme HP/HT emulsion system					•	•	12-45 L/m³	Y		
MAGMA-VERT NS	High-temperature, CEFAS substitution-free supplemental emulsifier and wetting agent for the North Sea					•	•	0.5-2.5 gal/bbl			
MP-MUL	Primary emulsifier for the MPRESS system/diesel oil based systems					•		0.5-2 gal/bbl			
NEXT-MUL	Primary emulsifier for the NEXT-DRILL system					•	•	9.5-18 L/m³			
NEXT-MUL HT	High Temperature, primary emulsifier for invert emulsion system					•	•	9.5-18 L/m³			
OMNI-MUL	High temp. emulsifier and wetting agent for synthetic muds					•	•	12-36 L/m³	Y		Y
OMNI-MUL 2	Emulsifer for synthetic drilling fluids					•	•	.5-1 gal/bbl			
OMNI-TEC	Anioic emulsifier for synthetic drilling fluids					•	•	14-40 L/m³			
OMNI-VERT	Supplemental emulsifier						•	0.5-1.5 PPB	Y		
BAROID FLUID SERVICES											
BaraMul IE-660	Oil mud emulsifier					•		0.5-18.0	Y		
BAROMUL 290, 303	Oil mud emulsifier					•		2.0-12.0			
BROMI-MUL	Brine-in-oil emulsifier			•		•		6	Y		
DRILTREAT	Oil wetting agent					•	•	0.25-2.0	Y	Y	Y
EZ MUL	Oil mud emulsifier					•		2.0-12.0			
EZ MUL 2F	Oil mud emulsifier					•	•	2.0-12.0			
EZ MUL NT	Oil mud emulsifier					•		2.0-12.0	Y		Y
EZ MUL NS	Oil mud emulsifier					•		2.0-12.0			
EZ MUL R	Oil mud emulsifier					•		2.0-12.0			
EZ-CORE	Fatty acid passive emulsifier for all-oil					•	•	1.0-4.0	Y		
FACTANT	Oil mud emulsifier/filtration control agent					•	•	1.0-4.0	Y		Y
FORTI-MUL	Oil mud emulsifier					•		2.0-12.0			
INVERMUL	Oil mud emulsifier					•		4.0-12.0			
INVERMUL NT	Oil mud emulsifier					•		4.0-12.0	Y		Y
LE SUPERMUL	Emulsifier for synthetic fluids						•	2.0-12.0			Y
PERFORMUL	Oil mud emulsifier					•	•	2.0-12.0	Y		Y
LAMBERTI SPA											
ALBISOL F10	Environmental friendly direct emulsifier					•	•	2-10%			Y
EMULAM HT	Emulsifier for HT conditions					•	•	5-12			
EMULAM PE	Primary emulsifier for OBM					•		1-10			
EMULAM PE/S	Primary emulsifier for SBM						•	1-10			
EMULAM SE	Secondary emulsifier for OBM					•		1-10			
EMULAM SE/S	Secondary emulsifier for SBM						•	1-10			
EMULAM WA	Wetting agent for OBM					•	•	1.0-10			
M-I SWACO											
ACTIMUL RD	Dry emulsifier and wetting agent in diesel					•	•	6-10			
ECOGREEN P	Primary emulsifier for ECOGREEN system						•	2-6	Y	N	
ECOGREEN S	Secondary emulsifier for ECOGREEN system						•	2-6	Y	N	
EMUL HT	HTHP emulsifier for VERSADRIL and VERSACLEAN systems					•	•	4-8	N	N	
FAZE-MUL	Emulsifier for FAZEPRO system					•	•	8-12	N	N	
FAZE-WET	Wetting agent for FAZEPRO System					•	•	2-4	N	N	
M-I 157	Supplemental emulsifier					•	•	0.5-2	N	N	
MEGAMUL	Basic emulsifier and wetting agent in MEGADRIL system						•	4-12			
MUL HTP	Primary emulsifier for negative alkalinity system					•	•	1-4	N	N	
NOVAMUL	Primary emulsifier & wetting agent for synthetic fluids						•	2-8	N	N	Y
NOVAPRO P/S	Primary emulsifier						•	6-10			
NOVAWET	Wetting agent for synthetic muds						•	1-5	N	N	Y
NOVATEC P	Primary emulsifier for NOVATEC system					•	•	2-6	N	N	
NOVATEC S	Secondary emulsifier for NOVATEC system					•	•	2-6	N	N	
ONE-MUL	emulsion stability, wetting agent, filtration control, and temperature stabilizer					•		8-10			
OILFAZE	Sacked oil-base concentrate					•		50	N	N	
PARAMUL	Primary emulsifier for OBM and SBM PARA systems					•	•	6-10.2			
PRIMO-MUL	High Internal phase ratio emulsifier					•	•				
SUREMUL	Primary emulsifier for SBM systems						•	6-10.2	N	N	Y
SUREMUL EH	Primary emulsifier for SBM systems						•	6-10.2			
SUREMUL PLUS	Primary emulsifier in RHELIANT PLUS system						•	8-10			
VERSACOAT	Wetting agent & emulsifier in VERSA Oil systems					•		1-8	N	N	
VERSACOAT HF	Organic surfactant emulsifier for oil muds in HT					•		1-8	N	N	
VERSACOAT NA	High flash point emulsifier for oil muds					•		1-8	N	N	
VERSAMUL	Primary emulsifier and wetting agent, liquid blend of emulsifiers, wetting agents, gelling agents and fluid stabilizers					•		4-10	N	N	
VERSAPRO P/S	Primary emulsifier, secondary wetting agent in VERSAPRO system					•		6-10	N	N	
VERSAWET	Wetting agent for OBM					•		1-4	N	N	

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
NEWPARK DRILLING FLUIDS											
CYBERCOAT	Surfactant and supplimental emulifier						•	0.5-2			Y
CYBERMUL	Low toxicity emulsifier						•	4-6			Y
CYBERPLUS	Low toxicity emulsifier						•	8-12			Y
OPTIMUL II	Organic emulsifier					•		2-8			
OPTIPLUS II	Organic emulsifier					•		2-8			
OPTITHIN	Organic thinner					•		0.1-5			
OPTIWET	Blend of emulsifying and wetting agents					•		0.25-8			
OptiVert	Primary emulsifier					•		2-8			
NOV FLUIDCONTROL											
PETRO-MUL I	Primary emulsifier					•		2-8			
PETRO-MUL I HT	Primary emulsifier for high temp applications										
PETRO-MUL II	Secondary emulsifier					•		2-8			
PETRO-MUL II HT	Secondary emulsifier for high temp applications										
PETRO-WET	Wetting agent for PETROS (diesel) mud										
PETRO-WET T	Concentrated wetting agent for PETROS (diesel) mud										
ECO-SYN PE	Primary emulsifier for synthetic base oils										
ECO-SYN SE	Secondary emulsifier synthetic base oils						•	2-8			
ECO-SYN WA	wetting agent for ECO-SYN invert muds										
ECO-SYN WA-T	Concentrated wetting agent for ECO-SYN muds										
OLEON N.V.											
RADIAGREEN EBL	Env. friendly ester based lubricant	•	•	•	•			0.5-3%	Y	N	Y
RADIAGREEN EME SALT	Lubricant for heavy brines	•	•	•				0.5-3%	Y	N	Y
E-24	Blend of emulsifying and wetting agents	•	•	•	•	•	•	2-4%		N	Y
FILTRATION CONTROL AGENTS											
AES DRILLING FLUIDS											
ENERNITE	Filtrate Reducer for oil based systems					•	•				
ENERPAC REGULAR	Polyanionic cellulose fluid loss additive, regular	•	•	•	•						
ENERPAC LO VIS	Polyanionic cellulose fluid loss additive, low viscosity	•	•	•	•						
FLR	Filtrate Reducer for oil based systems					•	•				
FLR PLUS	High Performance Filtrate Reducer					•	•				
DURATEC	Elastomeric HP/HT control additive					•	•				
DURATEC ER	Polymeric Fluid loss for ENERREACH system (oil, synthetic based)					•	•				
ES-Control	Filtrate Reducer for ENERSEALsystem		•	•	•						
BAKER HUGHES DRILLING FLUIDS											
BIO-LOSE	Complexed polysaccharide	•	•	•	•			2-4 pb			Y
BIO-PAQ	Organic derivative providing filtration control	•	•	•	•			1-4 ppb	Gold		Y
BIO-PAQ AR	High performance fluid loss control biopolymer				•			1-4 pb			
CARBO-TROL	Asphaltic filtration control additive for invert emulsion fluids					•		varies			
CARBO-TROL A-9	Non-asphaltic, non-polymeric HP/HT filtration reducer					•	•	5-10 ppb	E		
CARBO-TROL 375	High-temperature filtration control additive for invert emulsion fluids							2-6 ppb	E		
CHEMTROL X	HT filtration control agent for water-base fluids	•	•	•				2-6 pb			
DELTA-TROL	HT Starch for PERFFLOW system	•	•	•	•			4-7 pb			
ECCO-PAQ LV	Filtration control additive for freshwater systems	•	•	•	•			0.5-2 ppb			Y
FC-30	Flake carbonate			•							
KEM-SEAL	Co-polymer for high-temp. filtration control	•	•	•	•			0.25-6 ppb			Y
KEM-SEAL PLUS	Co-polymer for HT filtration control	•	•	•	•			1-2 ppb	Gold		Y
LATITROL	Fluid loss additive for LATIDRILL system	•	•	•	•			2-5 ppb			
MAGMA-SEAL	Fluid loss and sealing additive for MAGMA-TEQ extreme HP/HT emulsion system					•	•	4-8 ppb			
MAGMA-TROL	Polymeric fluid loss additive for MAGMA-TEQ extreme HP/HT emulsion system					•	•	0.5-7 ppb	Gold		
MAX-TROL	Sulfonated resin	•	•	•	•			2-8 ppb	Gold		Y
MIL-PAC LV	Low-viscosity polyanionic cellulose	•	•		•			1-4 ppb	E		
MIL-PAC LV PLUS	Saltwater tolerant low-viscosity polyanionic cellulose that meets API specifications	•	•	•	•			0.25-2 ppb	E		
MIL-PAC LVT	Low visc. tech-grade polyanionic cellulose	•	•		•			0.5-2 ppb	E		
MIL-PAC R	Polyanionic cellulose, regular viscosity	•	•					0.25-4 ppb	E		Y
MIL-PAC R PLUS	Saltwater tolerant polyanionic cellulose, regular viscosity	•	•	•	•			0.25-4 ppb	E		
MIL-PAC RT	Technical grade polyanionic cellulose, regular viscosity, API spec	•	•		•			0.5-3 ppb	E		
MIL-PAC ULV	Ultra-low visc. polyanionic cellulose	•	•		•			0.5-2 ppb	E		
MILSTARCH	Pregelatinized starch	•	•	•	•			1-5 ppb	E		Y
MP-FLC	Premium fluid loss control additive for the MPRESS system/diesel oil based systems					•		1-6 ppb			
NEXT-FLC	Premium fluid loss control additive for NEXT-DRILL invert system					•	•	1-6 ppb			
NEXT-SEAL	HP/HT filtration control agent for invert emulsions fluids					•	•	1-4 ppb			Y
PERMA-LOSE HT	Non-fermenting polymerized starch	•	•	•	•			1-5 ppb			Y
PYRO-TROL	FR and lubricant in extreme HPHT water base applications	•	•	•	•			0.25-2 ppb			Y
W-313	Filtration reducer for PERFFLOW system		•	•	•			5-7 ppb	Y		Y
BAROID FLUID SERVICES											
ADAPTA	Oil mud filtration control copolymer					•	•	1.0-6.0	Y		Y
ADAPTA 450	Extreme HP/HT IEF filtrate reducer					•	•	1.0-6.0			
AK-70	Asphaltic blend	•	•	•	•	•	•	5.0-15.0			Y
BARABLOK	Powdered gilsonite, wallcake enhancer	•	•	•	•	•	•	5.0-35.0	Y	Y	Y
BARABLOK 400	High-temp powdered gilsonite	•	•	•	•	•	•	5.0-35.0	Y	Y	Y
BARANEX	Modified lignin polymer	•	•		•			2.0-6.0	Y		Y
BARO-TROL PLUS	Shale stabilizer	•	•	•	•			2.0-6.0			Y
BXR	Borehole stabilizer	•	•	•	•			4.0-20.0			Y
BXR-L	Borehole stabilizer suspension	•	•	•	•			8.0-40.0			Y
CARBONOX	Leonardite	•	•	•	•			2.0-12.0	Y	Y	Y
DEXTRID	Modified starch with biocide	•	•	•	•			2.0-6.0			Y
DEXTRID E	Modified starch	•	•	•	•			2.0-6.0	Y	Y	
DEXTRID LT	Modified starch with biocide	•	•	•	•			2.0-6.0			Y

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
DEXTRID LTE	Modified starch with biocide	•	•	•	•			2.0-6.0			
DRILL STARCH	Pregelatinized starch	•	•	•	•			2.0-8.0			Y
DURATONE E	Oil mud filtration control additive					•		2.0-20.0	Y		Y
DURATONE HT	Oil mud filtration control additive					•	•	2.0-20.0			Y
DURENEX PLUS	Hi-temp filtration control additive					•	•	1.0-3.0			Y
FACTANT	Oil mud emulsifier/filtration control agent					•	•	1.0-4.0	Y		Y
FILTER-CHEK	Fermentation-resistant modified starch	•	•	•	•			1.0-5.0	Y	Y	Y
IMPERMEX	Pre-gelatinized starch	•	•	•	•			2.0-8.0	Y	Y	Y
LIQUITONE	Liquid polymeric filtrate reducer					•	•	1.0-4.0	Y		Y
N-DRIL HT PLUS	Modified starch							2.0-5.0	Y	Y	Y
PAC-L & PAC-LE	Low viscosity polyanionic cellulose	•	•	•	•			0.5-3.0	Y	Y	Y
PAC-R & PAC-RE	Regular polyanionic cellulose	•	•	•	•			0.5-2.0	Y	Y	Y
POLYAC PLUS	Polyacrylate	•	•	•	•			0.25-3.0			Y
THERMA-CHEK	High temperature filtrate reducer	•	•	•	•			1.0-8.0	Y		Y
CHEMTOTAL											
POLY-PLUS	Complexed Polysaccharide	•	•	•	•			2-4			Y
DRILLING SPECIALTIES CO.											
DRILLPAC HV POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRILLPAC LV POLYMER	Low viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISCAL D POLYMER	High temperature synthetic polymer	•	•	•	•			0.5-2.5		Y	Y
DRISPAC PLUS REGULAR	Dispersable HV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC PLUS SUPERLO	Dispersable LV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC REGULAR POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC SUPERLO POLYMER	Low viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISTEMP POLYMER	High temperature synthetic polymer	•	•	•	•			0.5-2.5		Y	Y
GREENBASE DRISPAC POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.5-5.0		Y	Y
GREENBASE HE-150 POLYMER	Brine viscosifier	•	•	•	•			3.0-15.0		Y	N
LIQUID HE-150 POLYMER	Brine viscosifier	•	•	•	•			2.0-10.0		Y	Y
HE-150 POLYMER	Brine viscosifier	•	•	•	•			1.0-5.0		Y	Y
HE-300 POLYMER	Fluid loss additve for slicate muds	•	•	•	•			1.0-5.0		Y	Y
LIQUID DRISPAC POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.5-4.0		Y	N
DSCO ORGANOLIG FILTRATE REDUCER	Fluid loss additive for oil muds					•	•	2.0-5.0		Y	Y
SOLTEX ADDITIVE	Sulfonated asphalt for HTHP filtrate control	•	•	•	•	•	•	2.0-6.0		Y	Y
POTASSIUM SOLTEX ADDITIVE	Potassium sulfonated asphalt for HTHP filtrate control	•	•	•	•	•	•	2.0-6.0		Y	Y
SOLTEX E ADDITIVE	Sulfonated asphalt	•	•	•	•	•	•	2.0-6.0		Y	Y
DRILL-SURE OBM ADDITIVE	Multi purpose OBM Additive					•	•	0.75-6.0		Y	Y
DRILL-WELL D210 FLA	Synthetic fluid loss additive for invert oil based fluids to 300° F					•	•	1.0-4.0			
DRILL-WELL D244 FLA	Synthetic fluid loss additive for invert oil based fluids to 375 °F in liquid form					•	•	2.0-4.0			
IMPACT FLUID SOLUTIONS											
FLC 2000	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
STAR SHIELD	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
STAR FLH	Wellbore stabilization/invasion control - OBM					•	•	4.0-6.0	Y		
LAMBERTI SPA											
CARBOCEL EHV	Extra high visc. CMC according to API/ISO	•	•	•	•			.2-4		Y	Y
CARBOCEL HV	High viscosity technical grade CMC	•	•	•	•			.2-4		Y	Y
CARBOCEL LV	Low viscosity CMC according to API/ISO	•	•	•	•			.2-5		Y	Y
CEPAC ELV	Extremely Low-viscosity PAC	•	•	•	•			.2-3		Y	Y
CEPAC LOVIS	Low-viscosity PAC	•	•	•	•			.2-3		Y	Y
CEPAC REGULAR	High-viscosity PAC	•	•	•	•			.2-3		Y	Y
EMULAM FC	Liquid fluid loss reducer for OBM					•	•	1-10			Y
EMULAM FC/NS	Liquid OBM FLR for North Sea					•	•	1-10	Y		Y
HYSOPOL FL	High temp. polymeric FR (up to 300°F)	•	•	•	•			1-10			Y
HYSOPOL FLN	Polymeric FLR for North Sea							1-10	Y		Y
HYSOPOL HT	High temperature polymeric FLR								Y		Y
K PAC LOVIS	Potassium low viscosity PAC	•	•		•			.2-3		Y	Y
K PAC REGULAR	Potassium high viscosity PAC	•	•		•			.2-3		Y	Y
LAMPAC CHL	Premium grade, low visc., purified PAC	•	•	•	•			.2-2		Y	Y
LAMPAC CHR	High visc., premium grade, purified PAC	•	•	•	•			.2-2		Y	Y
LAMPAC EXLO	Extremely low-viscosity PAC	•	•	•	•			.2-3		Y	Y
LAMPAC LOVIS	Low visc. purified PAC, according to API/ISO	•	•	•	•			.2-2		Y	Y
LAMPAC REGULAR	High visc., purified PAC, according to API/ISO	•	•	•	•			.2-2		Y	Y
LAMPAC NFE-L	Dispersible, premium, LV purified PAC	•	•	•	•			.2-2		Y	Y
LAMPAC NFE-R	Dispersible - HV, premium, purified PAC	•	•	•	•			.2-2		Y	Y
M-I SWACO											
ASPHASOL	Blend of sulfonated organic resins				•	•	•	4-10	N	N	Y
ASPHASOL D	Sulfonated organic blend, partially water soluble	•			•	•		2-10	N	N	
ASPHASOL SUPREME	Sulfonated asphalt	•	•	•	•	•		3-6	N	N	
CALOVIS FL	FL Control and Secondary Viscosifier for ENVIROTHERM system	•	•		•			2-5			
CALOVIS HT	FL Control and Secondary Viscosifier for ENVIROTHERM system	•	•		•			2-6			
CAUSTILIG	Causticized ground lignite	•			•	•		1-15	N	N	Y
DI-TROL	FCA for the DIPRO system				•			8			
DUAL-FLO	FCA for the FLOPRO NT system			•	•	•		4-6	N	N	Y
DUAL-FLO HT	FCA for high-temperature applications			•	•	•		2-7			
DURALON	Filtration control high-temperature polymer	•	•	•	•			1-8	N	N	
ECOTROL 717D	Filtration control resin for diesel					•		2-4			
ECOTROL L	Liquid filtration control for paraffin-, mineral oil- and synthetic oils					•	•	0.5-2.0			
ECOTROL RD	Version of ECOTROL used in PARALAND system					•	•	2-4			

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ECOTROL HT	Synthetic Co-Polymer in all oil high-temperature applications					•	•	2-4			
FLO-PLEX	Filtration control additive for the DRILPLEX system	•		•				2-6	Y	N	Y
FLO-PLEX PLUS	Filtration control additive for the DRILPLEX system	•		•				4-6			
FLO-TROL	Starch derivative for FLOPRO NT systems	•	•	•	•			2-4	Y	Y	Y
HIBTROL	FCA and secondary shale inhibitor	•	•		•			1-5	Y	N	
HIBTROL HV	FCA and secondary shale inhibitor	•	•		•			1.4-7	N	N	
HIBTROL ULV	Ultra-low vis FCA and secondary shale inhibitor	•	•		•			2.1-7			
K-17	Potassium causticized lignite	•	•	•	•			1-15	N	N	Y
KLAFLOC II	Cationic filtration control for floc water drilling		•					1-4 vol%			
LO-WATE	Acid soluble, powdered calcium carbonate	•	•	•	•	•	•	10-40	N	N	
M-I 157	Supplemental emulsifier					•	•	0.5-2	N	N	
M-I PAC R	Pure PAC polymer, technical grade	•	•		•			2-5	Y	Y	
M-I PAC UL	Pure PAC polymer, low viscosity	•	•		•			2-5	Y	Y	
MEGATROL	Filtration control in Diesel based systems						•	0.5-3			
MUL HTP	Primary emulsifier for negative alkalinity system					•	•	2-6	N	N	
MY-LO-JEL	Pregelatinized corn starch	•	•	•	•			4-8	Y	Y	
OILFAZE	Sacked oil-base concentrate						•	50	N	N	
ONETROL HT	Amine-treated tannin					•	•	4-10			
PARATROL HT	High-temperature gilsonite						•	2-8			
POLYPAC ELV	Extra-low viscosity PAC	•	•	•	•			0.5-2	Y	N	
POLYPAC R	Polyanionic cellulose	•	•	•	•			0.5-2	Y	Y	Y
POLYPAC SUPREME R	PAC, premium grade	•	•	•	•			0.5-2	Y	N	
POLYPAC SUPREME UL	PAC, premium grade, ultra-low viscosity	•	•	•	•			0.5-2	Y	N	
POLYPAC UL	PAC, ultra low-viscosity	•	•	•	•			0.5-2	Y	N	
POLY-SAL	Non-fermenting starch	•	•	•	•			2-6	N	N	Y
POLY-SAL HT	High-quality, preserved polysaccharide	•	•	•	•			2-6			
POLY-SAL T	Non-fermenting tapioca starch derivative	•	•	•	•			2-6	N	N	
POROSEAL	Latex-modified starch polymer	•	•	•	•			2-5 vol%			
RESINEX	High-temperature synthetic resin	•	•	•	•			2-6	N	N	Y
RESINEX II	High-temperature synthetic resin	•	•	•	•			2-10	N	N	
RESINEX EH	High-temperature synthetic resin	•	•	•	•			2-10	N	N	
SAFE-CARB	Sized ground marble	•	•	•	•	•	•	10-50	Y	N	
SAFE-VIS	Brine viscosifier	•	•	•	•			0.5-4	Y	N	
SAFE-VIS E	Liquid viscosifier for brines			•				5-10	Y	N	
SAFE-VIS HDE	Liquid viscosifier for high-density brines	•		•	•			14-29	N	N	
SAFE-VIS LE	Liquid viscosifier for brines			•				0.6-1.2 gal/bbl			
SAFE-VIS OGS	Specially formulated liquid HEC			•				.6-1.2 gal/bbl			
SHALE-CHEK	Shale control additive	•	•	•	•			5	N	N	
SP-101	Sodium polyacrylate polymer	•	•	•	•			0.5-2	N	N	Y
TANNATHIN	Ground lignite	•	•	•	•			1-15	N	N	Y
THRUCARB	Carbonate for the FLOTHRU system		•	•				5-12			
THRUCARB 20	Sized carbonate for the FLOTHRU system		•	•				5-12			
THRUTROL	Organicphillic starch for the FLOTHRU system		•	•				10-15			
TROL-PLEX	Modified starch in DRILPLEX AR PLUS	•						4-6			
UNIPAC SUPREME R	Dispersible high-viscosity PAC	•	•	•	•			0.25-1			
UNIPAC SUPREME UL	Dispersible regular-grade PAC	•	•	•	•			0.25-1			
UNITROL	Improved version of THERMPAC	•	•	•	•			0.25-1.5			
VERSALIG	Amine-treated lignite					•		2-12	Y	N	Y
VERSATROL	Naturally occurring gilsonite					•		2-8	Y	N	
VERSATROL HT	High-temperature gilsonite					•		2-8			
VERSATROL M	Medium softening point Gilsonite					•		2-8			
VERSATROL NS	Lignite/Gilsonite blend for HP/HT filtration					•		2-8			
VINSEAL	FCA & electrical stability additive	•	•	•	•	•		2-20			
XP-20 K	Potassium causticized chrome lignite	•		•	•			1-15	N	N	Y
XP-20 N	Chrome lignite, neutralized	•		•	•			1-15	N	N	
NEWPARK DRILLING FLUIDS											
CYBERTROL	Polymeric HP/HT filtration control agent						•	1-5			Y
DynaLose CM	carboxymethylated startch	•	•	•	•						Y
DYNALOSE W	White starch	•	•	•	•			2-6			Y
DYNALOSE Y	Yellow starch	•	•	•	•			2-6			Y
DYNANITE	Filtrate control agent	•	•	•	•	•	•	2-6			Y
DYNAPLEX	Resin	•	•	•	•			1-8			Y
EVOTROL	Filtrate control agent	•	•	•	•			1-8			Y
GAGETROL	Fluid loss control		•		•			4			Y
NEWLIG	Lignite	•	•	•	•			2-5			Y
NEWPAC LV	Polyanionic cellulose	•	•	•	•			0.25-2			Y
NEWPAC PLV	Premium-grade polyanionic cellulose	•	•	•	•			0.25-2			Y
NEWPAC PR	Premium-grade polyanionic cellulose	•	•	•	•			0.25-2			Y
NEWPAC R	Polyanionic cellulose	•	•	•	•			0.25-2			Y
OPTI G	Filtrate control agent					•		2-6			
OPTILIG	Amine treated lignite					•	•	1-12			
OPTITROL	Polymeric HP/HT filtration control agent					•		1-5			Y
NewEdge	Fluid conditioner and fluid loss reducer	•	•	•	•			2-10			
KronoTrol	Polymeric filtration control agent						•	1-5			Y
KronoTrol HT	Polymeric filtration control agent						•	1-5			Y
KronoTrol XT	Polymeric filtration control agent						•	1-5			Y
NOV FLUIDCONTROL											
AQUA-FILM CM	Carboxymethyl starch										
AQUA-FILM HP	Non-ionic hydroxypropyl starch										
AQUA-FILM HT	High temperature stable starch										
AQUA-FILMW	Pregelatinized white starch										
AQUA-FILM Y	Pregelatinized yellow starch										
AQUA-FILM T	Tapioca starch										
ECO-SYN FLR	Filtration control additive					•	•	1-6			Y
EP-CHEK	Polymeric HP/HT filtration control										
Gilsonite	Mineral asphalt, powdered, for NAF	•	•	•	•	•	•	1-6			
Gilsonite Dispersion	Liquid gilsonite blend	•	•	•	•			4-6			
HEC-LINK 11	Crosslinkable HEC for LCM for non zinc brine										
HEC-LINK 14	Crosslinkable HEC for LCM in zinc brine										
NOV FIBER	Ground and sized plant derived cellulose										
NOV LIG	Oxidized leonardite or lignite	•	•	•	•			2-6			
NOV LIG R	Resinated lignite										
NOV LIG K	Potassium lignite										

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NOV LIG PH	Causticized lignite										
NOV PAC LV	Polyanionic cellulose, low molecular weight	•	•	•	•			0.5-2			Y
NOV PAC R	Polyanionic cellulose, regular	•	•	•	•			0.5-1			Y
NOV PAC Plus LV	Polyanionic cellulose, low molecular weight	•	•	•	•			0.5-2			Y
NOV PAC Plus	Polyanionic cellulose	•	•	•	•			0.5-1			Y
NOV TROL	Viscosifier - liquid			•	•			0.25-4			
PAVE-BLOCK	Gilconite/asphalt blend										
PAVE-PLEX	Sulfonated asphalt/causticized lignite filtration control										
PAVE=TEX	Filtration control additive										
POLY-SPA	Sodium polyacrylate	•	•	•	•			1-2			
TURBO-CHEM INTERNATIONAL											
PREMIUM SEAL	Micronized cellulose fiber	•	•	•	•	•	•	4			Y
TURBO-PHALT	Gilsonite/resin	•	•	•	•			4			Y
FLOCCULANTS											
AES DRILLING FLUIDS											
ENERFLOC	Highly effective polymer flocculant forwater based fluids and dewatering	•	•	•	•						
BAKER HUGHES DRILLING FLUIDS											
MF-1	High molecular weight non-ionic selective flocculant				•						
BAROID FLUID SERVICES											
BARAFLOC	Flocculant for drilling fluids	•						0.01-0.25			Y
CLAY GRABBER	Liquid flocculant for HYDRO-GUARD	•	•	•	•			0.5-2.0			Y
CRYSTAL-DRIL	Flocculant for clear water drilling		•	•	•			0.2-1.0			
ENVIRO-COG C	Inorganic coagulant	•	•	•	•			0.05-1.0			
ENVIRO-COG S	Inorganic coagulant	•	•	•	•			0.05-1.0			
ENVIRO-FLOC 104	Polymeric flocculant	•	•	•	•			0.01-0.25			
ENVIRO-FLOC 109	Polymeric flocculant	•	•	•	•			0.01-0.25			
EZ-FLOC	Flocculant blend	•	•	•	•			0.01-0.25			
FLO-CLEAN MD	Flocculant for calcium brines							1-3 vol%			
FLO-CLEAN Z	Flocculant for zinc brines							1-3 vol%			
LAMBERTI SPA											
DRILLAM EL	PHPA shale inhibitor	•	•	•	•			0.3-3			
M-I SWACO											
FILTER FLOC	Flocculant for displacements			•	•			0.01-2.0 vol%			
FLOXIT	Organic flocculant		•		•			0.1-2	N	N	Y
GELEX	Polymer bentonite extender		•		•			0.05-0.2	N	N	Y
KLA-FLOC I	Low-cost shale inhibitor for floc water drilling		•		•			1-4 vol%			
KLA-FLOC II	Cationic flocculant for flow water drilling		•		•			1-4 vol%			
POLY-PLUS	High M.W. PHPA polymer		•	•	•			0.5-4	Y	N	Y
POLY-PLUS DRY	Dry PHPA polymer		•	•	•			.25-2		N	N
POLY-PLUS LV	Low-viscosity PHPA polymer		•	•	•			.25-2		N	N
POLY-PLUS RD	Readily dispersible powdered high m. w. PHPA		•	•	•			0.5-4	Y	N	Y
SAFE-FLOC I	Surfactant / flocculant solvent blend			•	•			1-4%	N	N	
SAFE-FLOC II	Surfactant / solvent blend			•	•			1-4%	N	N	
NOV FLUIDCONTROL											
ISO-DRILL	PHPA dispersion										
ISO-DRILL LV	low molecular weight PHPA										
ISO-DRILL Plus	PHPA dispersion 50%										
ISO-DRILL RD	granular PHPA		•	•	•			0.5-0.2			Y
FRICTION REDUCER FOR COIL TUBING											
CHEMTOTAL											
PAM-FR	Slurried Anionic Acrylamide based FR	•	•	•	•	•			N	N	Y
DRILLING SPECIALTIES CO.											
HE 150 POLYMER	Friction reducer	•	•	•	•			0.1-0.2		Y	Y
LIQUID HE 150 POLYMER	Friction reducer	•	•	•	•			0.1-0.2		Y	N
GREENBASE HE 150 POLYMER	Friction reducer	•	•	•	•			0.1-0.2		Y	Y
GREENBASE FLOWZAN POLYMER	Friction reducer	•	•	•	•			0.5-4.0		Y	Y
FLOWZAN BIOPOLYMER	Friction reducer	•	•	•	•			0.25-2.0		Y	Y
GELLING AGENTS/ VISCOSIFIERS											
ADM EVOLUTION CHEMICALS											
OPTIXAN D	Dispersed Xathan gum biopolymer	•	•	•	•			0.25-2.0			Y
OPTIXAN DT	Clarified Dispersed Xathan gum biopolymer	•	•	•	•			0.25-2.0			Y
OPTIXAN	Xanthan Gum biopolymer	•	•	•	•			0.25-2.0			Y
OPTIXAN FG	Xanthan Gum biopolymer	•	•	•	•			0.25-2.0			Y
AES DRILLING FLUIDS											
AES VIS	Organophillic Clay for oil based systems					•	•				
AES VIS II	Premium Organophillic Clay for all oil based fluid systems					•	•				
AES VIS III	Organophillic Clay for oil and synthetic based systems					•	•				
AES VIS LS	Optimal low shear rate rheology control in oil muds					•	•				
GEL	Premium Grade API Bentonite Gel for water based systems	•	•	•	•						
ENERVIS RM	Superior liquid Rheology modifier for oil based fluids					•	•				
ES-RM	Rheology Modifier for ENERSEAL system		•	•	•						
TRU VIS	High performance organophillic clay for mineral and synthetic based systems					•	•				
BAKER HUGHES DRILLING FLUIDS											
BENEX	Bentonite extender							2 lb/5-8 banf sacs			
CARBO-GEL	Organophilic clay for solids suspension					•	•	1-5			
CARBO-GEL II	Quick-yielding organophilic clay for solids suspension					•	•	4-8			
INFUSE XAN	Liquid xantham gum polymer in environmentally friendly base	•			•	•		0.5-3.0			
LATIBASE	Multi-functional additive	•	•	•	•			2-10 ppb			

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
MAGMA-GEL	Organophilic clay for MAGMA-TEQ extreme HP/HT emulsion system					•	•		Y		
MAGMA-GEL SE	Suspension Enhancer for MAGMA-TEQ extreme HP/HT emulsion system					•	•		Y		
MILGEL	Wyoming bentonite meeting API specifications	•	•	•	•			0-25	E		Y
MILGEL NT	Untreated Wyoming bentonite meeting API specs	•	•	•	•			0-25	E		Y
MILL-SWEEP	Viscosified system for milling casing	•		•	•			10-14 ppb			Y
MP-HOLD	Organophillic clay/cuttings suspension for the MPRESS system/diesel oil based systems					•		5-14 ppb			
MP-LIFT	Rheology modifier for the MPRESS system/diesel oil based systems					•		2-6 ppb			
MP-LIFT UL	Rheology modifier for the MPRESS system/diesel oil based systems					•		1-2 ppb			
NEXT-HOLD	A unique organophilic clay for cuttings suspension					•	•	5-14 ppb			
NEXT-LIFT UL	Rheology modifier for invert emulsion systems							1-2 ppb			
NEXT-LIFT	Rheology modifier for invert emulsion systems							2-6 ppb			
OMNI-PLEX	High-performance, anionic, synthetic polymer					•	•				
PRIME VIS HT	Viscosifier for high temperature displacements										
QUICK VIS	Liquid brine viscosifier - multi-salt systems			•	•			As needed	E	Y	
QUICK VIS HT	Liquid brine viscosifier - HT environment			•	•			As needed			
RHEO-CLAY	Fast yielding organophilic clay for RHEO-LOGIC deepwater system					•	•	2-4	Y		
RHEO-CLAY PLUS	Temperature-stable organophilic clay for RHEO-LOGIC deepwater system					•	•	2-4	E		
RHEO-LINE HT	Organic polymeric viscosifier for RHEO-LOGIC deepwater system- HT environment						•	0.5-3			Y
SALT WATER GEL	Attapulgite clay meeting API specifications	•	•	•				20			Y
SUPER-COL	Exrta-high-yield bentonite	•			•			0.5-5			Y
ULTRAVIS	Liquid brine viscosifier -single salt systems			•	•			As needed	E	Y	
VIS	Pure synthetic polymer	•	•	•	•			0.2-4.0			
W.O. 21	Hydroxethyl cellulose	•	•	•	•			1-3	E		
W.O. 21L	Liquid HEC viscosifier	•	•	•	•			.15-2.1 gal/bbl			
W.O. 21LE	Liquid HEC viscosifier for workover fluids - env. safe		•	•	•			0.3-1 gal/bbl			
W.O. 21 LE PLUS	Liquid HEC in environmentally friendly base	•		•	•			0.3-1 gal/bbl			
XAN-PLEX	Xanthan gum polymer	•	•	•	•			0.2-2	Y		
XAN-PLEX C	Clarified Xanthan gum polymer	•	•	•	•			0.2-2			
XAN-PLEX eL	Clarified Xanthan gum polymer	•		•	•			0.5-3.0	E		
XAN-PLEX D	Xanthan gum polymer	•	•	•	•			0.2-2	E		Y
XAN-PLEX T	Technical grade xanthan gum polymer										
XAN-PLEX TD	Technical grade dispersed xanthan gum polymer										
XCD POLYMER	Biopolymer			•	•			0.5-3.0	E	Y	
BAROID FLUID SERVICES											
AQUAGEL	Wyoming bentonite	•	•	•	•			5.0-25.0	Y	Y	Y
AQUAGEL GOLD SEAL	Untreated Wyoming bentonite	•	•	•	•			5.0-25.0	Y	Y	Y
BARACTIVE	Polar activator for all-oil systems					•	•	4.0-7.0	Y	Y	Y
BARAPAK	Oil-soluble polymer					•	•	2.0-3.0			Y
BARARESIN-VIS	Oil mud viscosifier			•	•	•		3-20			
BARAVIS	Modified cellulose	•	•	•	•			1-3	Y		Y
BARAZAN	Xanthan gum	•	•	•	•			0.1-2.0	Y	Y	Y
BARAZAN D	Dispersion enhanced xanthan gum	•	•	•	•			0.1-2.0	Y		Y
BARAZAN L	Xanthan suspension	•	•	•	•			0.5-4.0	Y		Y
BARAZAN D PLUS	Premium dispersion-enhanced xanthan	•	•	•	•			0.1-2.0	Y	Y	Y
BAROLIFT	Synthetic monofilament fiber	•	•	•	•	•	•	0.1-0.5	Y		Y
BORE-VIS II	Modified bentonite-BOREMAX system		•					5.0-15.0			
BROMI-VIS	Pre-dispersed polymer suspension			•	•			5.0-20.0			Y
GELTONE	Oil mud viscosifier					•	•	2.0-5.0			Y
GELTONE II	Oil mud viscosifier					•	•	2.0-15.0	Y		Y
GELTONE V	Oil mud viscosifier					•	•	1.0-15.0			Y
LIQUI-VIS EP	Non-ionic polymer dispersion	•	•	•	•			0.2-9.0			Y
MUD GEL	Treated, premium grade sodium bentonite	•	•	•	•			2.0-25.0			
N-VIS	Biopolymer	•	•	•	•	•	•	1.0-3.0			Y
N-VIS HI	Mixed metal silicates		•					1	Y		
N-VIS HI PLUS	Mixed metal silicate complex		•					0.5-2.0	Y		
N-VIS L	Liquid xanthan gum	•	•	•	•			0.2-9.0			Y
N-VIS O	Organophilic clay					•	•	1.0-6.0			
N-VIS P PLUS	Polymer Blend		•	•	•			1.0-4.0	Y	Y	Y
RHEMOD L	Modified fatty acid					•	•	1.0-4.0	Y		Y
RHEOBOOST	Oil mud viscosifier					•	•	0.5-4.0			Y
RM-63	Rheology modifier					•	•	0.5-2.0	Y		Y
SUSPENTONE	Organophilic clay					•	•	0.1-5.0	Y		Y
TAU-MOD	Amorphous/fibrous material					•	•	0.5-5.0	Y		Y
TEMPERUS	Modified fatty acid					•	•	0.25-2.5	Y		Y
THERMA-VIS	Synthetic inorganic viscosifier	•	•	•	•			1.0-4.0	Y		Y
X-TEND II	Bentonite extender	•	•	•	•			0.01-0.05			Y
VIS-PLUS	Organic viscosifier					•	•	1.0-5.0			Y
ZEOGEL	Attapulgite	•	•	•	•			5.0-30.0	Y	Y	Y
CHEMTOTAL											
FHG290	Diesel Slurriable Fast Hydrating Guar (FHG)	•	•	•	•			0.25-2	Y	N	Y
FHG280	Fast Hydrating Guar Gum Powder 8000 cps	•	•	•	•			0.25-2	Y	N	Y
FHG270	FHG Guar 7000 cps (35/40 cps)	•	•	•	•			0.25-2	Y	N	Y
CMHPG-MV	CMHPG (Carboxymethyl Hydroxypropyl Guar)	•	•	•	•			0.25-2	Y	N	Y
CMHPG-HV	CMHPG 40+ cps	•	•	•	•			0.25-2	Y	N	Y
XG-FG	Xanthan Gum Bio-polymer	•	•	•	•			0.25-2	Y	N	Y
XG-FGL	Liquid Xanthan Gum (Slurried)	•	•	•	•			1-5	Y	N	Y
CRODA											
HYPERMER A70	Emulsifier for oil-based muds					•	•	1-5%			
HYPERMER B246SF	Emulsifier for oil-based muds					•	•	1-5%			
Pripol 1029	Viscosifier for oil-based systems					•		1-5%			
Pripol 1045	Viscosifier for oil-based systems					•		1-5%			
Priamine 1074	Viscosifier for oil-based systems					•		1-5%			
DRILLING SPECIALTIES CO.											
CLARIZAN BIOPOLYMER	High viscosity clarified biopolymer	•	•	•	•			0.25-2.0	E	Y	Y
DRILLPAC HV POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y

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DRILLPAC LV POLYMER	Low viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRILLZAN D BIOPOLYMER	Economical high viscosity biopolymer	•	•	•	•			0.25-2.0		Y	Y
DRISCAL D POLYMER	High temperature synthetic polymer	•	•	•	•			0.5-2.5		Y	Y
DRISPAC PLUS REGULAR	Dispersable HV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC PLUS SUPERLO	Dispersable LV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC REGULAR POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC SUPERLO POLYMER	Low Viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
FLOWZAN BIOPOLYMER	High viscosity biopolymer	•	•	•	•			0.25-2.0		Y	Y
GREENBASE DRISPAC POLYMER	Liquid High Viscosity cellulosic polymer	•	•	•	•			0.5-5.0		Y	Y
GREENBASE FLOWZAN POLYMER	Liquid High viscosity biopolymer	•	•	•	•			0.5-4.0		Y	Y
GREENBASE HEC POLYMER	Liquid High Viscosity hydroxyethyl cellulose	•	•	•	•			0.5-5.0		Y	Y
HE 150 POLYMER	High viscosity synthetic polymer	•	•	•	•			1.0-2.0		Y	Y
LIQUID HE 150 POLYMER	High viscosity synthetic polymer	•	•	•	•			2.0-4.0		Y	Y
GREENBASE HE 150 POLYMER	High viscosity synthetic polymer	•	•	•	•			3.0-6.0		Y	Y
LIQUID DRISPAC POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.5-4.0		Y	N
LIQUID FLOWZAN BIOPOLYMER	High viscosity biopolymer	•	•	•	•			0.5-4.0		Y	N
LIQUID HEC POLYMER	High viscosity pure hydroxyethyl cellulosic polymer	•	•	•	•			0.5-5.0		Y	N
DRILL-WELL D294 RMA	Flat Rheology modifer of invert oil based drilling fluids good to 325 °F hot roll										
LAMBERTI SPA											
BIOLAM XG LS	Liquid xanthan viscosifier	•	•	•	•			0.25-2			Y
BIOLAM XG	Xanthan gum viscosifier	•	•	•	•			0.2-2			Y
BIOLAM XT	Biopolymer derivative viscosifier	•	•	•	•			0.2-2			Y
CARBOCEL EHV	Extra high visc. CMC according to API/ISO	•	•	•	•			0.2-4		Y	Y
CARBOCEL HV	High viscosity technical grade CMC	•	•	•	•			0.2-4		Y	Y
CEPAC REGULAR	High viscosity technical grade PAC	•	•	•	•			0.2-3		Y	Y
DRILLAM EL	Liquid PHPA	•	•	•	•			0.3-3			
EMULAM REO1	Low shear rate rheology modifier					•	•	0.5-2	Y		Y
EMULAM RM	Rheology modifier for OBM					•	•	1-4			
EMULAM RM 77	Rheology modifier for OBM					•	•	1-4			
EMULAM VIS	Organoclay / Gelling agent for OBM					•	•	1-5			
EMULAM V PLUS	High yield Organoclay / Gelling agent					•	•	1-5			
LAMGUM 200	High viscosity guar gum	•	•	•	•			0.2-4		Y	Y
LAMPAC CHR	High visc., premium grade, purified PAC	•	•	•	•			0.2-2		Y	Y
LAMPAC REGULAR	High visc., purified PAC, according to API/ISO	•	•	•	•			0.2-2		Y	Y
LAMPAC NFE-R	Dispersible - Purified premium HV PAC	•	•	•	•			.2-2		Y	Y
SPUD-VIS	Viscosifier for spud muds		•		•			0.2-2			Y
M-I SWACO											
ACTI-BUILD	Polar activator for Eastern Hemisphere					•	•				
DI-BALANCE	Viscosifier for the DIPRO system			•				0.25-2			
DI-BOOST	Secondary viscosifier for DIPRO system			•				.03-.06 gal/bbl			
DRILPLEX	Viscosifier for DRILPLEX system		•		•			1-3			Y
DRILPLEX HT	MMO viscosifier for high temperature		•		•			2-7	N	N	N
DRILPLEX LT	MMO viscosifier for low temperature		•		•			1-3	N	N	N
DUO-TEC	Xanthan gum polymer	•	•	•	•			0.25-2	Y	N	
DUO-TEC NS	Xanthan gum polymer, non-dispersible for North Sea use	•	•	•	•			0.25-2	Y	N	Y
DUO-VIS	Xanthan gum dispersible polymer	•	•	•	•			0.25-2	Y	N	Y
DUO-VIS L	Liquified Xanthan gum, non-clarified	•	•	•	•			0.25-0.5	Y	N	
DUO-VIS NS	Xanthan gum, non-dispersible for North Sea use	•	•	•	•			0.5-2.5	Y	N	Y
DUO-VIS PLUS	Premium Grade of Xanthan gum	•	•	•	•			0.25-2	Y	N	Y
DUO-VIS PLUS NS	Premium Grade of Xanthan gum, non-dispersible for North Sea use	•	•	•	•			0.25-2	Y	N	N
DUROGEL	Sepiolite clay	•	•	•	•			5-30	N	N	Y
FLO-VIS L	Non-dispersible clarified Xanthan gum	•	•	•	•			.25-.5 gal/bbl			
FLO-VIS NT	Non-dispersible, non-clarified Xanthan gum	•	•	•	•			0.25-2.5			
FLO-VIS PLUS	Premium clarified Xanthan for FLOPRO NT systems	•	•	•	•			0.75-2.25	N	N	
GELEX	Polymer bentonite extender		•		•			0.05-0.2	N	N	Y
GELPLEX	Viscosifier for the DRILPLEX system		•					7-10			
HIBTROL HV	Fluid loss additive and secondary shale inhibitor	•	•		•			1.4-7			
HRP	Liquid viscosifier & gelling agent for oil muds					•		1-6	N	N	
M-I GEL	Premium grade treated Wyoming bentonite	•	•	•	•			5-35	Y	Y	
M-I GEL SUPREME	Non-treated bentonite, API spec	•	•	•	•			5-35	N	N	Y
M-I GEL SUPREME WYOMING	Non-treated API Wyoming bentonite	•	•	•	•			5-35	N	N	Y
M-I GEL WYOMING	API-spec bentonite Wyoming source only	•	•	•	•			5-35	N	N	
M-I PAC R	Pure PAC polymer, regular grade	•	•		•			2-5	Y	Y	
NOVAMOD	Low-shear rate viscosifier						•	1-5	N	N	Y
NOVATEC M	Low-end rheology modifier						•	1-3	N	N	
POLYPAC R	Polyanionic cellulose	•	•	•	•			0.5-2	Y	Y	Y
POLYPAC SUPREME R	Polyanionic cellulose, premium grade	•	•	•	•			0.5-2	Y	N	
POLY-SAL	Non-fermenting starch	•	•	•	•			2-6	N	N	Y
POLY-SAL HT	High-quality, preserved polysaccharide	•	•	•	•			2-6			
POLY-SAL T	Non-fermenting tapioca starch derivative	•	•	•	•			2-6	N	N	
POWER VIS	Viscosifier: creates less pump pressure & thermal convection				•			0.875-1.25			
POWER VIS L	Liquid version of POWER VIS viscosifier				•			.125-.5 gal/bbl			
RHEBUILD	Viscosifier for RHELIANT system						•	0.25-0.5			
RHEFLAT	Rheology modifier for RHELIANT system						•	0.5-3			
RHETHIK	Rheology modifier for RHELIANT system						•	0.25-1			
SAFE-VIS	Brine viscosifier	•	•	•	•			0.5-4	Y	N	
SAFE-VIS E	Liquid HEC			•				5-10	Y	N	
SAFE-VIS HDE	Liquid HEC for high-density brines	•		•	•			14-29	N	N	
SAFE-VIS LE	Liquid viscosifier for brines			•				0.6-1.2 gpb			
SAFE-VIS OGS	Specially formulated liquid HEC			•				0.6-1.2 gpb			
SALT GEL	Attapulgite clay	•	•	•	•			5-35	Y	Y	Y
SUPRAVIS	Viscosifier for the ULTRADRIL system			•	•			0.25-2			
SUREMOD	Viscosifier for SBM systems						•	1-4	N	N	Y
SURETHIK	Rheological modifier						•	0.25-1	N	N	
TARVIS L	Liquid viscosifier for the SAGDril system				•			0.25-0.5 gpb	N	N	
TRUVIS	Primary viscosifier for TRUDRIL systems					•		0-8	N	N	
UNIPAC SUPREME R	Dispersible, high-viscosity PAC	•	•	•	•			0.25-1			
VERSAGEL HT	Hectorite					•		0-8	Y	N	
VERSAMOD	Oil mud gelling agent and viscosifier					•		1-3	N	N	
VERSAMUL	Primary emulsifier and wetting agent					•		2-10	N	N	
VERSAPAC	Thermally activated organic thixotrope					•	•	5-30	N	N	
VG-69	Organophilic clay					•	•	2-10	N	N	Y
VG-PLUS	Improved organophilic clay					•	•	2-10	Y	N	
VG-SUPREME	Organophilic clay for the NOVA systems						•	2-10			
NEWPARK DRILLING FLUIDS											
CYBERVIS DW50	Polymeric rheological modifyier					•	•	0.25-2.5			Y
CYBERVIS RM	Polymeric rheological modifyier					•	•	<4			Y
EVOMOD	HP/HT synthetic low-end rheology mod.	•	•		•			0.1-2			Y
EVOVIS	HP/HT polymeric rheology modifier		•		•			0.25-6			Y
GAGEVIS	MMO		•	•	•			0.8-1.2			Y
NEWBAR	4.2 SG barite	•	•	•	•	•	•				Y
NEWGEL	Montmorillonite	•	•	•	•			5-30			Y
NEWGEL NT	Untreated montmorillonite	•	•	•	•			5-30			Y
NEWWATE	4.1 SG barite	•	•	•	•	•	•				Y
NEWZAN D	Biopolymer	•	•	•	•			0.2-2			Y
OPTIVIS RM	Polymeric rheological modifyier					•		<4			
NOV FLUIDCONTROL											
HEC-VIS L	Viscosifier - liquid	•	•	•	•			0.25-4			Y
HEC-VIS	HEC viscosifier										
CEP	Polymeric viscosifier emulsion for NAF										
FLO-MOD LE	Low end rheology modifier for NAF										
FLO-MOL TA	Low end rheology modifier for NAF										
PREMA-VIS HT	Organophilic hectorite viscosifier for HT NAF applications					•	•	4-10			Y
PREMA-VIS	Organophilic Wyoming bentonite clay					•	•	4-10			
PREMA-VIS Plus	Premium organophilic Wyoming bentonite clay										
NOV GEL	Treated bentonite clay for aqueous drilling fludis	•	•	•	•			6-35			
NOV GEL NT	Non-treated bentonite clay for aqueous drilling fluids	•	•	•	•			6-35			Y
NOV GEL HY	Non-treated bentonite clay for aqueous drilling fluids	•	•	•	•			6-35			Y
NOV XAN D	Xanthan gum	•	•	•	•			0.25-4			Y
RHE-TEMP	Temporary viscosifier for NAF										
NOV XAN L	Xanthan gum	•	•	•	•			0.25-4			Y
OLEON N.V.											
EMS 6+	Rheology modifier					•	•	0.5-3%		N	Y
TURBO-CHEM INTERNATIONAL											
SWELLCM	Gelled, swelling, sealing agent	•	•	•	•	•	•				Y
INTERVENTION FLUIDS											
M-I SWACO											
FLODENSE AP	High density displacing fluid for casing pressure remediation			•				17.5-20.5 ppg			Y
FLOPRO CT	Coiled tubing drilling / intervention fluid		•	•	•			8.5-9.5 ppg			Y
LOSS CIRCULATION, SEALING MATERIALS											
AES DRILLING FLUIDS											
CAL CARB MIX	Sized calcium carbonate use as bridging agent	•	•	•	•	•	•				
EO SEAL II	Additive for seepage losses, micro fracture sealant and well bore strengthening	•	•	•	•	•	•				
ENERLOC	Lost control additive for partial to severe losses	•	•	•	•	•	•				
MULTIFIBER	Cellulosic fiber blend for lost control	•	•	•	•	•	•				
PERMASEAL	Mineral fiber based materials for rapid sealing and healing losses	•	•	•	•	•	•				
SILVERSEAL	Sized LCM blend	•	•	•	•	•	•				
BAKER HUGHES DRILLING FLUIDS											
BRIDGEFORM	Single sack bridging solution			•	•	•	•	2-15 ppb	E	Y	Y
CARBO-SEAL	Modified hydrocarbon LCM for sealing					•	•	Varies	Y		
CHEK-LOSS	Complex cellulosic LCM	•	•	•	•			4-8+ ppb	Y	E	
CHEK-LOSS COARSE	Coarse, complexed cellulosic for loss of circulation	•	•	•	•	•	•	4-8+ ppb	Y	E	
CHEK-LOSS PLUS	High-lignin cellulosic LCM particularly for OBM/NAF with less adverse effect on PV and ES					•	•	4-8+ ppb	Y	E	
ECCO-FIBER Fine	Environmentally friendly cellulosic LCM	•	•	•	•			As needed			
ECCO-FIBER Medium	Environmentally friendly cellulosic LCM	•	•	•	•			As needed			
ECCO-SHELL SERIES	Environmentally friendly LCM	•	•	•	•			As needed			
FLO-GUARD-L	Drilling fluid and cement LCM system			•	•				E	E	
FLO-GUARD-LC	Drilling fluid and cement LCM system				•	•					
FLOW-CARB SERIES	Multiple grind size series of calcium carbonate	•	•	•	•			Varies			
LC-LUBE	Sized, synthetic graphite	•	•	•	•	•	•	2-8 ppb	Y	E	
LC-LUBE FINE	Sized, synthetic graphite	•	•	•	•	•	•	2-8 ppb	Y	E	
LC-SHIELD	Sized, calcined petroleum coke	•	•	•	•	•	•	6-20 ppb			
LC-SHIELD FINE	Sized, calcined petroleum coke	•	•	•	•	•	•	6-20 ppb			
KOMPRESS	Single sack lost circulation solution			•	•	•	•	Varies	E	Y	Y
MAGNA-PLUS	Acid soluble bridging material		•	•	•			As needed	E		Y
MAX-BRIDGE	Customized bridging system			•	•	•	•	varies	Y		
MIL-CARB SERIES	Sized ground calcium carbonate	•	•	•	•	•	•	1-50 ppb	E		
MIL-CEDAR FIBER	Shredded cedar bark	•	•	•	•			5-10 ppb	Y		
MILFLAKE	Shredded cellophane	•	•	•	•			varies			
MILMICA	Muscovite mica	•	•	•	•	•	•	5-10 ppb	E		
MIL-PLUG	Ground nut shells	•	•	•	•	•	•	5-10 ppb	E		
MIL-SEAL	Blended LCM product	•	•	•	•			5-10 ppb	E		

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
NEXT-SEAL	LCM for seepage losses					•	•	1-4 ppb			Y
SOLUFLAKE D SERIES	Flaked calcium carbonate	•	•	•	•	•	•	2-8 ppb	Y	Y	
POLY-FX	Polymeric LCM low density brines	•	•	•	•	•					
SOLUFLAKE D	Flaked calcium carbonate for drilling	•	•	•	•	•	•	2-8 ppb	Y		
SOLU-SQUEEZE	Acid-soluble LCM	•	•	•	•	•	•	Varies	Gold		
TEKPLUG XL	Pre Cross linked fluid loss polymer			•					Gold		Y
TEKPLUG XL HD	Pre Cross linked fluid loss polymer			•							
THERMO-PLUG I	Crosslinked LCM system			•							
THERMO-PLUG II	Crosslinked LCM system			•							
W.O. 30	Sized, ground calcium carbonate (Multiple grind sizes available)	•	•	•	•	•	•	5-40 ppb	Y		
X-LINK	Cross-linked polymer system	•	•	•	•	•	•				
XL STABILIZER	pH control additive			•							
BAROID FLUID SERVICES											
BaraBlend-665	Premium granular, high fluid loss LCM			•	•						
BARACARB 5, 25, 50, 150, 400, 600, 1200	Sized acid-soluble marble	•	•	•	•	•	•	5-60	Y	Y	Y
BARACARB DF 5, 25, 50, 150, 600	Sized acid-soluble marble	•	•	•	•	•	•	5-60	Y	Y	Y
BARAFLAKE M, C	Flaked calcium carbonate	•	•	•	•	•	•	5-20	Y	Y	Y
BaraLock-666 (.F, .M, .C)	Premium fine, medium and course-sized reticulated foam LCM	•	•	•		•	•	0.2-0.5			
BARAPLUG 20, 50, 6/300	Sized salt	•		•				5-60	Y	Y	Y
BaraShield-663	Premium fine-sized granular multi-modal LCM	•	•	•	•	•	•	5-40			
BaraShield-664	Medium-sized granular multi-modal LCM	•	•	•	•	•	•	5-50			
BAROFIBRE	Seepage-loss additive, regular & coarse	•	•	•	•	•	•	5-50	Y	Y	Y
BAROFIBRE SUPERFINE	Seepage-loss additive, fine	•	•	•	•	•	•	5-50	Y	Y	Y
BAROFIBRE O	Oleophylic seepage-loss additive	•	•	•	•	•	•	5-50			
BARO-SEAL Classic	Sized LCM blend	•	•	•	•			5-50		Y	Y
BARO-SEAL Coarse	Sized LCM blend	•	•	•	•			5-50		Y	Y
BARO-SEAL Fine	Sized LCM blend	•	•	•	•			5-50		Y	Y
BARO-SEAL Medium	Sized LCM blend	•	•	•	•			5-50		Y	Y
DUO-SQUEEZE H, R	Bimodal size blend for high loss zones	•	•	•	•	•	•	40-100			
EZ-PLUG	Acid soluble LCM Blend	•	•	•	•	•	•	5-90			Y
FUSE-IT	Synthetic polymer-based blend	•	•	•	•	•	•	Pill form			Y
HYDRO-PLUG	Sized Particulate and hydratable polymeric blended material	•	•	•	•	•	•	Pill form			Y
HYDRO-PLUG NS	Sized Particulate and hydratable polymeric blended material	•	•	•	•	•	•	Pill form	Y	Y	Y
N-PLEX	Activator for N-SQUEEZE	•	•	•	•	•	•	As needed	Y	Y	
N-SEAL	Inorganic LCM	•	•	•	•	•	•	As needed			Y
N-SQUEEZE	Polymer Lost circulation material	•	•	•	•	•	•	As needed		Y	Y
PLUG-GIT	Processed cedar fiber	•	•	•	•	•	•	3-10	Y	Y	Y
PLUG-GIT H	Processed hardwood fiber	•	•	•	•	•	•	3-10	Y	Y	Y
STOPPIT	Multi-modal sized LCM blend	•	•	•	•	•	•	50-80			
STOP-FRAC D	Pelletized blend of LCM	•	•	•	•	•	•	10-15			Y
STOP-FRAC S	Pelletized blend of coarse LCM	•	•	•	•	•	•	50-70 Pill			
STEELSEAL 25, 50, 100, 400, 1000	Dual composition carbon compound	•	•	•	•	•	•	5.0-30	Y	Y	Y
WALL-NUT F, M, C	Ground walnut shells	•	•	•	•	•	•	10-40	Y	Y	Y
DRILLING SPECIALTIES CO.											
DIASEAL M LCM	Sized diatomaceous earth blend	•	•	•	•	•	•	17-50		Y	Y
DYNARED FINE	Ground cellulosic fiber for seepage control	•	•	•	•	•	•	2.0-10.0		Y	Y
DYNARED MEDIUM	Ground cellulosic fiber for seepage control	•	•	•	•	•	•	2.0-10.0		Y	Y
DYNARED COURSE	Ground cellulosic fiber for seepage control	•	•	•	•	•	•	2.0-10.0		Y	Y
DYNA-SEAL FINE	Cellulosic fiber for seepage loss in oil muds	•	•	•	•	•	•	2.0-10.0		Y	Y
DYNA-SEAL ULTRA FINE	Cellulosic fiber for seepage loss in oil muds	•	•	•	•	•	•	2.0-10.0		Y	Y
DYNA-SEAL MEDIUM	Cellulosic fiber for seepage loss in oil muds	•	•	•	•	•	•	2.0-10.0		Y	Y
TORQUE-SEAL LPM/LCM	LPM/LCM for casing and horizontal drilling	•	•	•	•	•	•	2.0-30.0		Y	Y
SURE-SEAL LPM	LPM for Wellbore Strengthing	•	•	•	•	•	•	30.0-50.0		Y	Y
WELL-SEAL LCM FINE	Blended LCM for Lost Circulation	•	•	•	•	•	•	2.0-40		Y	Y
WELL-SEAL LCM MEDIUM	Blended LCM for Lost Circulation	•	•	•	•	•	•	10-40		Y	Y
WELL-SEAL LCM COARSE	Blended LCM for Lost Circulation	•	•	•	•	•	•	10-50		Y	Y
IMPACT FLUID SOLUTIONS											
FLC 2000	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
STAR SHIELD	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
STAR FLH	Wellbore stabilization/invasion control - OBM					•	•	4.0-6.0	Y		
STAR SEAL 4000	LCM - sand and gravel sealant	•	•	•	•	•	•	35 - 45	Y	Y	Y
LCP 2000	Lost circulation pill for severe losses	•	•	•	•	•	•	45 - 75	Y	Y	Y
STAR SAND SEAL (Fine/Coarse)	Lost circulation and seepage control additive	•	•	•	•	•	•	5 - 25	Y	Y	Y
STAR THERMOSET (Fine/Medium)	Lost circulation material	•	•	•	•	•	•	5 - 15	Y		Y
M&D INDUSTRIES OF LOUISIANA											
DRILL XPRESS	Liquid Viscosifier for WB Fluids	•	•	•	•			Situational			Y
LIQUID BRIDGE PLUG	Resin Based LCM Plug	•	•	•	•	•	•	Situational			
POLY PLUG ULTRA SQUEEZE	Cross link polymer de-watering slurry	•	•	•	•	•	•	Situational			
ULTRA SEAL-C	Coarse cellulosic fiber blend	•	•	•	•	•	•	15-25			Y
ULTRA SEAL-PLUS	Massive loss fiber LCM	•	•	•	•	•	•	25-40			Y
ULTRA SEAL-POLY PLUG	Fibers and crosslink polymer	•	•	•	•	•	•	Situational			Y
ULTRA SEAL-TG	Tech grade cellulosic fibers	•	•	•	•	•	•	7-9			Y
ULTRA SEAL-XLA	Cross link polymer temp. accelerator	•	•	•	•	•	•	Situational			
ULTRA SEAL-XLD	Cross link mixing enhancer	•	•	•	•	•	•	Situational			
ULTRA SEAL-XLR	Cross link polymer temp. retarder	•	•	•	•	•	•	Situational			Y
ULTRA SEAL-XP	Cellulosic fiber blend	•	•	•	•	•	•	5-7			Y
ULTRA SPACER	High fluid loss mud spacer	•	•	•	•	•	•	Hole dicates			Y
ULTRA SEAL CLEAR GEL	Solids free cross link polymer	•	•	•	•	•	•				Y

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
M-I SWACO											
C-SEAL	Coke FLCA	•	•	•	•	•	•	15-20	N	N	
C-SEAL F	Coke FLCA - fine grind	•	•	•	•	•	•	15-20	N	N	
CLEANPERF	Fluid-loss system for perforating operations				•	•		System			Y
FORM-A-BLOK	High-performance, high-strength blend	•	•	•	•	•	•	20-40			
FORM-A-PLUG II	Pumpable lost circulation plug	•	•	•	•	•	•	100%			
FORM-A-PLUG ACC	Accelerator for FORM-A-PLUG pill	•	•	•	•	•	•	3.5-10.5			
FORM-A-PLUG RET	Retarder for FORM-A-PLUG pill	•	•	•	•	•	•	3.5-17.5			
FORM-A-SET	Polymeric lost circulation material	•	•	•	•	•	•	25-50	Y	N	
FORM-A-SET ACC	Accelerator for FORM-A-SET pill	•	•	•	•	•	•	1-5	N	N	
FORM-A-SET AK	Polymeric LCM	•	•	•	•	•	•	25	N	N	
FORM-A-SET AKX	Variant of FORM-A-SET AK pill for water shutoff	•	•	•	•	•	•	11-17.5	N	N	
FORM-A-SET RET	Retarder for FORM-A-SET pill	•	•	•	•	•	•	0-20	N	N	
FORM-A-SET XL	Crosslinker for FORM-A-SET pill	•	•	•	•	•	•	1-2	N	N	
FORM-A-SQUEEZE	High-solids, high-fluid loss plug	•	•	•	•	•	•	80			
G-SEAL	Coarse-sized graphite	•	•	•	•	•	•	15-20	Y	Y	
G-SEAL FINE	Fine-sized graphite	•	•	•	•	•	•	15-20			
G-SEAL HRG	High-resiliency graphite	•	•	•	•	•	•	5-10			
G-SEAL HRG FINE	High-resiliency graphite	•	•	•	•	•	•	5-10			
G-SEAL PLUS	Coarse-sized plugging agent	•	•	•	•	•	•	15-20			
G-SEAL PLUS C	Blend for lost circulation and wellbore strengthening	•	•	•	•	•	•	15-20			
LO-WATE	Sized ground limestone	•	•	•	•	•	•	10-40	N	Y	
M-I CEDAR FIBER	Shredded cedar bark fiber	•	•	•	•			5-30	Y	N	
M-I SEAL	LCM for fractured or vugular formations	•	•	•	•	•	•	5-20	N	N	
M-I-X II	Ground cellulosic fibers	•	•	•	•	•	•	5-20	Y	Y	
M-I 198	Coarse-ground high-temp Gilsonite					•					
NUT PLUG	Ground nut shells	•	•	•	•	•	•	5-50	Y	Y	Y
OPTISEAL I	Loss prevention material	•	•	•	•	•	•	30-70			
OPTISEAL II	Loss prevention material	•	•	•	•	•	•	30-70			
OPTISEAL III	Loss prevention material	•	•	•	•	•	•	30-70			
OPTISEAL IV	Loss prevention material	•	•	•	•	•	•	30-70			
PERF-N-PEEL	WBM FL/damage control system for perforated completions			•	•			System			
RESEAL	Highly compressive graphite	•	•	•	•	•	•	15-20			
SAFE-CARB	Sized ground marble	•	•	•	•	•	•	10-50	Y	N	
SAFE-LINK	Cross linked polymer (no zinc)			•				32pails/10bbl	N	N	
SAFE-LINK 110	Cross linked polymer (no zinc)			•				32pails/10bbl	N	N	
SAFE-LINK 140	Cross linked polymer high density			•				32pails/10bbl	N	N	
SEAL-N-PEEL	Removable loss control pill			•	•			8.4-17.5 ppg			
VERSAPAC	Thermally activated organic thixotrope					•	•	5-30	N	N	
VERSATROL	Naturally occurring asphalt					•		2-8	Y	Y	
VINSEAL	Filtration control additive particularly effective in depleted zones	•	•	•	•	•	•	2-5			
NEWPARK DRILLING FLUIDS											
CYBERSEAL	Fiberous seepage control agent					•	•	10-35			Y
DYNAFIBER	Micronized cellulose	•	•	•	•	•	•	F, M, C			Y
NEWBRIDGE	Sweep / bridging material	•	•	•	•	•	•	2-15			Y
NEWCARB	Sized calcium carbonate	•	•	•	•	•	•	F, M, C			Y
NEWCARB ULTIMIX	Coarse calcite / marble	•	•	•	•	•	•	25-50			Y
NEWPLUG	Nut shell	•	•	•	•	•	•	2-20			Y
NEWSEAL	Sized carbonaceous seepage agent	•	•	•	•	•	•	5-15			Y
X-PRIMA	One-sack, high-solids squeeze	•	•	•	•	•	•				Y
NOV FLUIDCONTROL											
BORE-SWELL	Swelling LCM										
Cedar fiber	Cedar fiber LCM										
Cottonseed hulls	Ground cottonseed waste material										
Drilling paper	Shreaded paper LCM			•	•			.25-4 dry powder			
Enviroplug	Bentonite chips										
KWIK SEAL	Granules, flakes, fibers	•	•	•	•			25			Y
LCF Blend	Ground and sized high lignin content cotton										
MAGMA FIBER	Lost circulation material			•	•			5-25			
MAXI SEAL	Blended LCM										
MICA	Mica	•	•	•	•			25			Y
NOV CARB	Calcium carbonate, ground and sized			•	•						
NOV FIBER	Ground plant fibers	•	•	•	•			4			Y
NOV OBM SEAL	LCM for use in NAF										
NUT PLUG	Nutshells	•	•	•	•			10-30			
NOV PLUG X	Sized Organic Blend	•	•	•	•			20			Y
SEAL-UP	Blended LCM			•	•			0.25-4			
Shur-Plug	Ground hardood chips for LCM										
Sawdust	Shreaded wood chips										
XP911	Carbon based LCM										
Walnut Shells											
SLIPSEAL G	Graded carbon compound	•	•	•	•	•	•				
TURBO-CHEM INTERNATIONAL											
E Z SQUEEZE	High solids, high fluid loss squeeze material	•	•	•	•	•	•	32-100 ppb			Y
PREMIUM SEAL	Micronized cellulose fiber	•	•	•	•	•	•	4			Y
FIRST RESPONSE	Single sack sized particulate blend	•	•	•	•	•	•	15-60 ppb			Y
SWELLCM	Gelled, swelling, sealing agent	•	•	•	•	•	•	10 ppb			Y
SYN SEAL	Seepage loss additive for synthetic & base mud					•	•	10-50 ppb			Y
TURBO-PHALT	Gilsonite/resin	•	•	•	•			4			Y
POLYMER BREAKERS											
CHEMTOTAL											
BR-PC20	Chlorite based delayed breaker for guar	•		•				As needed	N	N	Y
BR-PS20	Persulfate based breakers for organic polymers	•		•				As needed	N	N	Y
BR-EN	HP/HT Enzyme breaker	•	•	•	•			As needed	Y	N	Y
POLYMER CROSSLINKERS											
CHEMTOTAL											
XL – ZrBL	Boron Zirconium Dual Crosslinker	•	•	•	•	•		0.80%	N	N	Y
XL – Zr	Zirconium Chelate for HTHP conditions	•	•	•	•			0.80%	N	N	Y
XL – TAA	Titanium chelate (Titanium Acetyl Acetonate)	•	•	•	•			0.80%	N	N	Y
XL – TEA	Titanium chelate (Triethanolamine Titanate)	•	•	•	•	•		0.80%	N	N	Y
XL – Bo	Chelated Boron for HTHP conditions	•	•	•	•			0.80%	N	N	Y

SHALE CONTROL

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
AES DRILLING FLUIDS											
CLAYSHIELD	Liquid Amine Clay Inhibitor		•	•	•						
ENERZAN	Premium Grade Xanthan Gum viscosifier and inhibition	•	•	•	•						
ENERZAN L	Premium Grade Xanthan Gum viscosifier in liquid form	•	•	•	•						
ES-K	Primary Inhibitor for ENERSEAL fluid system		•	•	•						
ES-G	Secondary Inhibitor for ENERSEAL fluid system		•	•	•						
KCl Substitute	Clay Stabilizer for water based systems	•		•	•						
POLYPRO G	Polyglycol shale inhibitor	•	•	•	•						
PXL BLUE	Non-ionic Polyacrylamide for reactive clay stabilization	•	•	•	•						
SHALETEX II	Sulfonated Asphalt for inhibition	•	•	•	•	•	•				
BAKER HUGHES DRILLING FLUIDS											
AQUA-COL	Glycol used to control sensitive shales, increase lubricity and lower HT-HP filtrate in freshwater and saltwater systems		•	•	•			3%	Gold		
AQUA-COL B	Cloud-point glycol for shale control in medium-salinity systems		•		•			3-5%	Gold		
AQUA-COL D	Glycol used to control sensitive shales, increase lubricity and lower HT-HP filtrate in moderate to high-salinity systems		•		•			3%	Gold		
AQUA-COL S	Glycol used to control sensitive shales, increase lubricity and lower HT-HP filtrate in high-salinity systems		•		•			4%	Gold		
CHEK-TROL	Clay swelling & hydration suppressant	•	•	•	•			2-3%			
CLAY-TROL	Amphoteric surfactant	•	•	•	•			4-8 ppb	Y		
ECCO-BLOK	Water-dispersible natural resinous material for shale stabilization	•	•	•	•			2-6 ppb			
ECCO-GLYCOL	Glycol for shale control	•	•	•	•			Varies			
LATIMAGIC	Asphaltic material, sized graphite and deformable polymer	•	•	•	•	•		2-6 ppb			
MAX-GUARD	Clay hydration suppressant	•	•	•	•			1-7 ppb			
MAX-PLEX	Aluminum and resin complex for shale stability	•	•	•	•			1-5 ppb	Gold		
MAX-SHIELD	Deformable sealing polymer for shale stability	•	•	•	•			2-4%	Y		
MAX-SHIELD NS	Deformable sealing polymer	•	•	•	•			2-4%			
NANOSHIELD	Dry deformable sealing polymer for shale stability	•	•	•	•			1-5 lb/bbl	Gold		
NEW-DRILL	Liquid emulsion, high-molecular weight PHPA	•	•	•	•			1.5-2%	Y		
NEW-DRILL HP	Powdered polymer for improved shale control	•	•	•	•			1.5-2 ppb	Y		
NEW-DRILL LV	Powdered, low viscosity PHPA	•	•	•	•			1-3 ppb			
NEW-DRILL LV STICK	Low-viscosity PHPA polymer in stick form	•	•	•	•			as needed			
NEW-DRILL NY	Cuttings encapsulant approved for use in Norway	•	•	•	•			1-3 ppb			
NEW-DRILL PLUS	Powdered, high-molecular weight PHPA	•	•	•	•			1-3 ppb	Gold		
NEW-DRILL STICK	PHPA polymer in stick form	•	•	•	•			As needed			
PROTECTOMAGIC	Oil-soluble, air-blown asphalt used with oil	•	•	•	•			2-8 ppb			
PROTECTOMAGIC M	Water-dispersible, air-blown asphalt	•	•	•	•			2-8 ppb	Y		
SHALE-BOND	Water-dispersing, naturally-occurring asphalt	•	•	•	•			2-6 ppb	Y		
SHALE-PLEX	Aluminum complex for shale stability	•	•	•	•			1-4 ppb			
SULFATROL	Sulfonated asphaltic material	•	•	•	•			2-6 ppb	Y		
SULFATROL XCEED	High performance sulfonated asphaltic material	•	•	•	•			2-6 ppb	Y		
TERRA-COAT	Dry, deformable sealing polymer for HPWBM	•	•	•		•	•	2 ppb			Y
BAROID FLUID SERVICES											
AK-70	Asphaltic blend	•	•	•	•	•	•	5.0-15.0			Y
BARABLOK	Powdered gilsonite, wallcake enhancer	•	•	•	•	•	•	5.0-35.0	Y		Y
BARABLOK 400	Hi-temp powdered gilsonite	•	•	•	•	•	•	5.0-35.0			Y
BARACAT	Cationic polymer solution	•						1.0-3.0			Y
BARASIL-S	Sodium silicate solution		•					2-10%	Y	Y	
BARO-TROL PLUS	Enhanced shale stabilizer	•	•	•				2.0-6.0			Y
BORE-HIB	Shale inhibitor blend-BOREMAX system		•					1-2 vol%			
BORE-HIB II	Liquid inorganic salt blend	•	•	•							
BORE-PLUS	Shale stabilizer-BOREMAX system		•					0.2-3			Y
BXR	Borehole stabilizer	•	•	•	•			4.0-20.0			Y
BXR-L	Borehole stabilizer suspension	•	•	•	•			8.0-40.0			Y
CLAY FIRM	Shale stabilizer-HYDROGUARD system		•					5.0-8.0			Y
CLAY GRABBER	Shale encapsulator	•	•	•	•			0.5-2.0			Y
CLAY SYNC	Shale stabilizer-HYDROGUARD system		•					2.0-4.0	Y		Y
CLAY SYNC II	Shale stabilizer-HYDROGUARD system		•					2.0-4.0			Y
CLAYSEAL	Amphoteric compound shale stabilizer	•	•	•	•			4.0-8.0			Y
CLAYSEAL PLUS	Amphoteric compound shale stabilizer	•	•	•	•			4.0-8.0	Y		Y
EZ-MUD	Shale stabilizing polymer solution	•	•	•	•			1.0-4.0			Y
EZ-MUD DP	Powdered shale stabilizing polymer	•	•	•	•			0.25-1.5	Y		Y
EZ-MUD GOLD	Beaded shale stabilizing polymer	•	•	•	•			0.25-1.5	Y		Y
GEM CP	Polyglycol	•	•	•	•			5-7%	Y		Y
GEM GP	Polyalkylene glycol	•	•	•	•			2-6%	Y		Y
GEM SP	Polyglycol	•	•	•	•			2.0-15.0	Y		
PERFORMATROL	Shale inhibitive polymer		•	•	•			2-3%	Y		Y
DRILLING SPECIALTIES CO.											
DRILLPAC HV POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRILLPAC LV POLYMER	Low viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISCAL D POLYMER	High temperature synthetic polymer	•	•	•	•			0.5-2.5		Y	Y
DRISPAC PLUS REGULAR	Dispersable HV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC PLUS SUPERLO	Dispersable LV polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC REGULAR POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISPAC SUPERLO POLYMER	Low Viscosity polyanionic cellulose	•	•	•	•			0.25-2.5		Y	Y
DRISTEMP POLYMER	High temperature synthetic polymer	•	•	•	•			0.5-2.5		Y	Y
GREENBASE DRISPAC POLYMER	Liquid High Viscosity cellulosic polymer	•	•	•	•			0.5-5.0		Y	Y
LIQUID DRISPAC POLYMER	High viscosity polyanionic cellulose	•	•	•	•			0.5-4.0		Y	N
POTASSIUM SOLTEX ADDITIVE	Potassium sulfonated asphalt	•	•	•	•	•	•	2.0-6.0		Y	Y
SOLTEX E ADDITIVE	Sulfonated asphalt	•	•	•	•	•	•	2.0-6.0		Y	Y
SOLTEX ADDITIVE	Sulfonated asphalt	•	•	•	•	•	•	2.0-6.0		Y	Y
DRILL-SURE OBM ADDITIVE	Multi purpose OBM Additive					•	•	0.75-6.0		Y	Y
IMPACT FLUID SOLUTIONS											
FLC 2000	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
STAR SHIELD	Wellbore stabilization/invasion control	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
STAR FLH	Wellbore stabilization/invasion control - OBM					•	•	4.0-6.0	Y		
STAR HIB L	Shale control/clay inhibitor - low chlorides	•	•	•	•			2%-5%	Y		Y
STAR HIB S	Shale control/clay inhibitor - low chlorides	•	•	•	•			2%-5%	Y		Y
STAR HIB PLUS	Shale control/clay inhibitor - low conductivity	•	•	•	•			2%-5%	Y		Y
STAR HIB SF	Shale control/clay inhibitor - chloride free	•	•	•	•			2%-5%	Y		Y
LAMBERTI SPA											
HYBSTAR CFA	Chloride free neutralized polyamine	•	•	•	•			1-3%	Y		Y
HYBSTAR HS	Neutralized polyamine hydration suppressant	•	•	•	•			1-3%	Y		
HYBSTAR L	Amine derivative based	•	•	•	•			1-3%			
BORESTAB 1040	Borehole stabilizer		•		•			1-3%			
DRILLAM EL	Liquid PHPA encapsulator	•	•	•	•			0.3-3			
K PAC LOVIS	Potassium low viscosity PAC	•	•		•			0.2-3			Y
K PAC REGULAR	Potassium high viscosity PAC	•	•		•			0.2-3			Y
PAG 102	Polyglycol inhibitor (Low cloud point)	•	•	•	•			3%			Y
PAG 211	Polyglycol inhibitor (Medium Cloud Point)	•	•	•	•			3%	Y		Y
M-I SWACO											
ASPHASOL	Blend of sulfonated organic resins			•	•			4-10	N	N	Y
ASPHASOL D	Sulfonated organic blend	•		•	•			4-10	N	N	
ASPHASOL SUPREME	Sulfonated asphalt	•	•	•	•	•		2-8			
DI-INHIB	Shale inhibitor for the DIPRO system			•				3 vol%			
DRILPLEX	Viscosifier for DRILPLEX system		•		•			1-3			Y
DRIL-KLEEN	Low-toxicity detergent	•	•	•	•			0.2-1	N	N	Y
ENVIROBLEND	Salt for ENVIROVERT system					•					
FLOXIT	Clay flocculant		•		•			0.1-2	N	N	Y
GLYDRIL GP	Polyalkylene glycol with low cloud point	•	•	•	•			7-17.5	Y	N	
GLYDRIL HC	Polyalkylene glycol with high cloud point	•	•	•	•			7-17.5	N	N	
GLYDRIL LC	Polyalkylene glycol with low cloud point	•	•	•	•			7-17.5	Y	N	
GLYDRIL MC	Polyalkylene glycol with medium cloud point	•	•	•	•			7-17.5	Y	N	
HIBTROL	Fluid loss additive & secondary shale inhibitor	•	•		•			1-5	Y	N	
HIBTROL HV	Fluid loss additive & secondary shale inhibitor	•	•		•			1.4-7			
HIBTROL ULV	Ultra-low vis filtration control additive and secondary shale inhibitor	•	•		•			2.1-7			
IDCAP D	Polymeric shale inhibitor	•		•				1-4	Y	N	Y
INHIBYCOL XT	Wide-molecular-weight glycol	•	•	•	•			7-17.5			
K-17	Potassium lignite	•		•	•			1-15	N	N	Y
K-52	Non-chloride potassium supplement	•	•	•	•			1-5	N	N	Y
KLA-CURE	Hydration suppressant		•	•	•			4-8	Y	N	Y
KLA-CURE II	Hydration suppressant and detergent	•	•	•	•			4-8			
KLA-GARD	Shale inhibitor & hydration suppressant		•	•	•			4-8	Y	N	Y
KAL-GARD B	Salt-free KLA-GARD	•	•		•			4-8	N	N	Y
KLA-HIB	Liquid amine shale inhibitor	•		•	•			4-10			
KLA-PLEX	Potassium-base shale inhibitor		•		•						
KLA-SENTRY	Shale inhibitor for lignosulfonate muds	•						4-10			
KLA-STOP	Shale inhibitor		•	•	•			2-4 vol%	N	N	
KLA-STOP NS	Shale inhibitor		•	•	•			2-4 vol%			
KLAFLOC I	Low-cost shale inhibitor for floc water drilling		•					1-4 vol%			
M-I PAC R	Pure PAC polymer, technical grade	•	•		•			2-5	Y	Y	
M-I PAC UL	PAC polymer, low viscosity, technical grade	•	•		•			2-5	Y	Y	
PARAMIX A	Salt for the PARALAND system						•	25-40% wt			
PARAMIX N	Salt for the PARALAND system						•	25-40% wt			
POLYPAC R	Polyanionic cellulose	•	•	•	•			0.5-2	Y	Y	Y
POLYPAC ELV	Extra-low-viscosity PAC	•	•	•	•			0.5-2	Y	N	
POLYPAC SUPREME R	PAC, premium grade	•	•	•	•			0.5-2	Y	N	
POLYPAC SUPREME UL	PAC, premium grade, ultra-low viscosity	•	•	•	•			0.5-2	Y	N	
POLYPAC UL	PAC, ultra-low viscosity	•	•	•	•			0.5-2	Y	N	
POLY-PLUS	High m.w. PHPA polymer		•	•	•			0.5-4	Y	N	Y
POLY-PLUS DRY	Dry PHPA polymer		•	•	•			0.25-2			
POLY-PLUS LV	Low-viscosity PHPA polymer		•	•	•			0.25-2	N	N	
POLY-PLUS RD	Readily dispersible PHPA dry powder		•	•	•			0.5-4	Y	N	Y
POROSEAL	Latex-modified starch polymer	•	•		•			2-5 vol%			
SHALE-CHEK	Shale control additive	•	•	•	•			5	N	N	
SILDRIL D	Dry sodium silicate		•	•	•			9-15%	Y	Y	
SILDRIL K	Potassium silicate version of SILDRIL		•	•	•			8-12%			
SILDRIL L	Liquid sodium silicate		•	•	•			5-8%	Y	Y	
SP-101	Sodium polyacrylate polymer	•	•	•	•			0.5-2	N	N	Y
TARCLEAN	Anticrete agent for heavy oil				•			100% app			
ULTRACAP	Encapsulator for ULTRADRIL system				•	•		1.5-3			
ULTRACAP NS	Biodegradable shale encapsulator				•	•		1.5-3			
ULTRACAP PLUS	Polymeric shale inhibitor for ULTRADRIL system				•	•		2-4			
ULTRAHIB	Shale inhibitor for ULTRADRIL system				•	•		2-4 vol%			
ULTRAHIB NS	ULTRAHIB variant for North Sea				•	•		2-4 vol%			
UNIPAC SUPREME UL	Dispersible, regular-grade PAC	•	•	•	•			0.25-1			
XP-20K	Potassium causticized chrome lignite	•		•	•			1-15	N	N	Y
XP-20 N	Chrome lignite, neutralized	•		•	•			1-15	N	N	
NEWPARK DRILLING FLUIDS											
DEEPDRILL INHIBITOR	Proprietary HPWB shale inhibitor	•	•	•	•			3-20 vol%			Y
FLEXFIRM	Potassium silicate shale stabilizer		•		•			0.1-4			Y
HIPERM	Amine shale inhibitor		•	•	•			0.3-0.6 vol%			
LST-MD	Liquid sulfonated asphalt	•	•	•	•			2-3 vol%			
NEWPHASE	Blend of polyglycerols					•	•	1-10			
NEWPHALT	Sulphonated asphalt blend	•	•		•	•	•	2-8			
NEWPHPA	PHPA	•	•	•	•			0.2-2			Y
NEWPHPA D	PHPA	•	•	•	•			0.25-1			Y

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
NEWPHPA DLMW	Low molecular weight anionic PHPA	•	•	•	•			1-3			Y
NEWPHPA DSL	Very low molecular weight PHPA	•	•	•	•			1-4			Y
New100N	Blend of polyglycerines	•	•	•	•	•	•	3-4 vol%			Y
NOV FLUIDCONTROL											
Gilsonite, powdered	Mineral Gilsonite	•	•	•	•	•		2-8			Y
PAVE-BLOCK	Gilconite/asphalt blend										
PAVE-PLEX	Sulfonated asphalt/causticized lignite filtration control										
PAVE=TEX	filtration control additive										
K-TROL	Potassium acetate, liquid	•	•		•			2-6			
NOV TEX	Proprietary Blend	•	•	•	•	•		1-5			Y
POTASSIUM CHLORIDE	Salt			•	•			As needed			
Soltex	Asphalt	•	•	•	•			4-8			Y
Gilsonite, aqueous dispersion	Gilsonite blend liquid	•	•	•	•			2-6			
STARTROL	Asphalt blend	•	•	•	•			2-6			
TRAXX TC	Proprietary ROP enhancer / shale stabilizer										
VAPR G	Medium cloud point glycol										
VAPR S	Low cloud point glycol										
VAPR P	High cloud point glycol										
TERALINE	Choline chloride clay stabilizer										
TERAPERM	Permanent clay stabilizer										
TERAPLUS	Choline chloride/t-mac blended clay stabilizer										
TERASTAY	T-mac shale stabilizer										
TRIPLE A	Anti-accretion agent	•	•	•	•			.5-3.0%			Y
OLEON N.V.											
RADIAGREEN EBL	Env. friendly ester based lubricant	•	•	•	•			1-3%	Y	N	Y
RADIAGREEN EBO	General purpose lubricant & ROP enhancer	•	•	•	•	•	•	4-6%	Y	N	Y
RADIAGREEN EME SALT	Lubricant for heavy brines	•	•	•				1-3%	Y	N	Y
RADIAGREEN SL	Lubricant for pH system >10	•	•	•				2-5%	Y	N	Y
TURBO-CHEM INTERNATIONAL											
TURBO-PHALT	Gilsonite/resin	•	•	•	•			4			Y
SPOTTING FLUIDS, LUBRICANTS											
AES DRILLING FLUIDS											
DRILL BEADS	Copolymer drilling beads for mechanical lubricity	•	•	•	•	•	•				
ENERLUBE	Friction and torque reducing lubricant for fresh water systems	•	•		•						
ENERLUBE III	Friction and torque reducing lubricant for brine, completion and extreme pressure wells	•	•	•							
GXM	Engineered aspect ratio graphite used as a mechanical lubricant	•	•	•	•	•	•				
GXM PLUS	High performance crystalline graphite designed for mechanical lubrication	•	•	•	•	•	•				
BAKER HUGHES DRILLING FLUIDS											
AQUA-MAGIC	Differential sticking preventative for depleted zones	•	•	•	•			2-4%	Y		
BIO-DRILL	Polyol-based drilling/ROP enhancer	•	•	•	•			2-4%	Y		
BIO-SPOT	Non-hydrocarbon, low toxicity spotting fluid	•	•	•	•			As needed	Y		Y
BLACK MAGIC	Oil-base spotting fluid	•	•	•	•			As needed			
BLACK MAGIC CLEAN	Environmentally-safe spotting fluid	•	•	•	•			As needed	Y		
BLACK MAGIC LT	Low-toxicity, oil-base spotting fluid	•	•	•	•			As needed			
BLACK MAGIC PHALT FREE	Spotting fluid without asphalt	•	•	•	•	•	•	As needed	Y		
BLACK MAGIC SFT	Oil-base spotting fluid concentrate	•	•	•	•			As needed	Y		
ECCO-LUBE	WBM lubricant	•	•	•	•			0.5-2%			
LATILUBE	High temperature lubricant	•	•		•			2-4%			
LATIMAGIC	Wellbore stabilizer and lubricant	•	•		•			5-10 ppb			
LATIRATE	Rate of penetration enhancer and lubricant for water-based fluids	•	•		•			2-4%			
LC-GLIDE	Spherical carbon material for torque and drag reduction	•	•	•	•	•	•	2-12 ppb	E	Y	
LC-LUBE	Sized, synthetic graphite	•	•	•	•	•	•	2-8 ppb	Y		
LC-LUBE FINE	Sized, synthetic graphite	•	•	•	•	•	•	2-8 ppb	E		
LC-LUBE PLUS	Sized, synthetic graphite and petroleum coke blend	•	•	•	•	•	•	2-8 ppb	E		
LUBE-622	WBM lubricant	•	•	•	•			2-4%	Y		
LUBRI-GLIDE COARSE	Spherical CPC friction reducer	•	•	•	•	•	•	As needed			
LUBRI-GLIDE FINE	Spherical CPC friction reducer	•	•	•	•	•	•	As needed			
MIL-GLIDE	Spherical glass drilling bead used as a boundary lubricant	•	•	•	•	•	•	2-6 ppb			
MIL-GLIDE FINE	Fine grade spherical glass drilling bead	•	•	•	•	•	•	2-6 ppb			
MIL-GLIDE CP	Spherical copolymer drilling bead used as a boundary lubricant	•	•	•	•	•	•	2-12 ppb			
MIL-GLIDE CP FINE	Fine spherical co-polymer drilling bead	•	•	•	•	•	•	2-12 ppb			
MIL-GRAPHITE	Graded graphite used primarily to enhance lubricity and sliding	•	•	•	•	•	•	5-20 ppb			
MIL-LUBE	Vegetable oil-base boundary and extreme pressure lubricant	•	•	•	•			2-4%	Y		
NAVI-LUBE	Low-pour point lubricant	•	•	•	•			2-4%			
NF2	Gas hydrate inhibitor	•	•	•	•			10-40%	Y		Y
NF3	Gas hydrate inhibitor	•	•	•	•	•		5-40%			Y
OMNI-LUBE V2	Lubricant for invert emulsion drilling fluids					•	•	2-5%	E		
PENETREX	ROP enhancer and anti-bit balling/accretion additive	•	•	•	•			2-3%	Y		
PENETREX NS	ROP enhancer—designed for North Sea applications	•	•	•	•			2-3%	Gold		
PLUG-DRILL FR	Friction reducer for plug-drill outs		•	•				1-2.5 ppb			
PROTECTOMAGIC	Oil soluble, air-blown asphalt used with oil	•	•	•	•			2-6 ppb			
PROTECTOMAGIC M	Water-dispersible, air-blown asphalt	•	•	•	•			2-6 ppb	Y		
SUPER INSULGEL	Insulating packer fluid for deepwater			•	•			As needed			
TEQ-LUBE II	Environmentally-acceptable lubricant for WBM	•	•	•				3-5%			
TEQ-LUBE NS	Environmentally-acceptable lubricant for WBM in the North Sea	•	•	•				3-5%	Y		
WIN-LUBE	Low pourpoint lubricant for brines			•				1-8%			
BAROID FLUID SERVICES											
BARO-LUBE GOLD SEAL	Surfactants/lubricant blend	•	•	•	•			2.0-6.0			Y
BARO-LUBE NS	Surfactants/lubricant blend	•	•	•	•			2.0-6.0	Y		Y
CMO-568	Oil mud lubricant					•		2.0-6.0	Y		
DRIL-N-SLIDE	ROP enhancer	•	•	•	•			2.0-5.0%	Y		Y
EZ SPOT	Spotting fluid concentrate	•	•	•	•			As needed			
ENVIRO-TORQ	Broad-spectrum lubricant	•	•	•	•			2.0-6.0			Y
EP MUDLUBE	Extreme-pressure lubricant	•	•	•	•			2.0-6.0			Y
EZ GLIDE	Lubricant		•		•			1.0-3.0			Y
GRAPHITE	Carbon platelets	•	•	•	•	•	•	5.0-40.0	Y	Y	Y
LIQUI-DRIL	ROP enhancer	•	•	•				< 1.0			Y
LUBRA-BEADS	Copolymer bead lubricant, F and C	•	•	•	•	•	•	4.0-8.0			Y
NXS-LUBE	Extreme-pressure lubricant	•	•	•	•			2.0-8.0			Y
QUIK-FREE	High performance spotting fluid	•	•	•	•			As needed			Y
STICK-LESS 20	Spherical glass beads	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
TORQ-TRIM 22	Lubricant	•	•	•	•			2.0-6.0			
TORQ-TRIM II	Lubricant	•	•	•	•			2.0-6.0	Y		Y
TORQ-TRIM II PLUS	Lubricant	•	•	•	•			2.0-6.0	Y		Y
TORQUE-LESS DI-170	Spherical glass beads	•	•	•	•	•	•	4.0-8.0	Y	Y	Y
XLR-RATE	ROP enhancer		•	•	•			1.0-4.0			Y
CRODA											
CRODAFOS O4A	Lubricant				•	•	•	2-5%			
EstaDril 4000	Brine-tollerant lubricant for water-based systems	•	•	•	•			2-5%			
LAMBERTI SPA											
DRILQUICK AC	ROP enhancer, anti accretion	•	•	•	•			1-3%			
EMULUBE OBM	Effective OBM lubricant					•	•	1-3%			
FRONLUBE 100	Top range lubricant for salty environment	•	•	•	•	•	•	1-3%			
FRONLUBE 200	Top range, ester based lubricant	•	•	•	•	•	•	1-3%			
FRONLUBE OBM	Lubricant for oil based systems	•	•	•	•	•	•	1-3%			
LUBRICANT CD	All purpose lubricant	•	•	•	•			1-3%			
LUBRICANT CT	Coiled Tubibng lubricant	•	•	•	•			1-3%			
LUBRICANT EHB	Environmental friendly lubricant for heavy brines	•	•	•	•			1-3%			
LUBRICANT EP	Extreme pressure lubricant	•	•	•	•			1-3%			
LUBRICANT ER	For dispersed system	•						1-3%			
LUBRICANT F/458	Lubricant for high temperature	•	•	•	•			1-3%			
LUBRICANT SL	Lubricant for silicate fluids	•	•	•	•			1-3%			
LUBRICANT CBR 600	Environmentally friendly brine soluble	•	•	•	•			1-3%	Y		Y
LUBRICANT 29	Cost effective, environmentally friendly lubricant	•	•	•	•			1-3%			
LUBRICANT 45	General purpose environmental friendly	•	•	•	•			1-3%			
LUBRICANT 73	Water soluble lubricant	•	•	•	•			1-3%			
PRESANTIL	Pipe freeing agent for unweighted spotting fluids	•	•	•	•	•	•	5-20			
PRESANTIL FDP	Environmental friendly pipe-freeing agent	•	•	•	•	•	•	5-20			
PRESANTIL OBM	Effective OMB pipe-freeing agent					•	•	5-20			
PRESANTIL W	Pipe freeing agent for weighted spotting fluids	•	•	•	•	•		30			
PRESANTIL WNF	Non flammable pipe freeing agent (weighted)	•	•	•	•	•	•	30-50			
M-I SWACO											
ALPINE SPOTTING BEADS	Lubricating beads	•	•	•	•			8-12			
D-D	Drilling detergent	•	•	•	•			0.5-6	N	N	Y
DRILFREE	High-performance lubricant, anti-sticking agent	•	•	•	•			1-3%	Y	N	
DRIL-KLEEN	Anti bit balling agent	•	•	•	•			0.2-1.0	N	N	Y
DRIL-KLEEN II	Anti bit balling agent	•	•	•	•			0.2-0.5	N	N	
GLYDRIL GP	Polyalkylene glycol with low cloud point	•	•	•	•			7-17.5	Y	N	
GLYDRIL HC	Polyalkylene glycol with high cloud point	•	•	•	•			7-17.5	N	N	
GLYDRIL LC	Polyalkylene glycol with low cloud point	•	•	•	•			7-17.5	Y	N	
GLYDRIL MC	Polyalkylene glycol with medium cloud point	•	•	•	•			7-17.5	Y	N	
G-SEAL	Coarse sized graphite	•	•	•	•	•	•	15-20	Y	Y	
IDLUBE XL	Extreme pressure lubricant	•	•	•	•			1-6 vol%			
LOTORQ	Lubricant for FLOPRO system in Alaska	•	•	•	•			1-3 vol%			
LUBE-PLEX	Lubricant for enhanced DRILPLEX system	•						1-3 vol%			
LUBE XLS	Extreme pressure lubricant	•	•	•	•			1-6 vol%			Y
LUBE-100	Low-toxicity lubricant	•	•	•	•			4-6	N	N	Y
LUBE-167	Lower-toxicity lubricant	•	•	•	•			4-16	Y	N	Y
LUBE-776	Lubricant for LSND muds		•					1-3 vol%			
LUBE 945	WBM lubricant	•	•	•	•			4-16			
M-I LUBE	General-purpose lubricant	•	•	•	•			1-3%	N	N	
PIPE-LAX	Stuck pipe surfactant	•	•	•	•	•		8.3	N	N	Y
PIPE-LAX ENV	Low-toxicity stuck pipe solution	•	•	•	•			1	N	N	Y
PIPE-LAX ENV WH	Water soluble low toxicity stuck pipe solution	•	•	•	•			1			
PIPE-LAX OB	Stuck pipe solution for Invert Emulsion systems					•	•	100%			
PIPE-LAX W EXPORT	Stuck pipe solution concentrate	•	•	•	•	•		3030%	N	N	Y
SAFE-LUBE	Water-soluble brine lubricant			•				0.6 vol%	N	N	
SAFE-LUBE CW	Water-soluble brine lubricant for cold weather			•				0.6 vol%			
SCREENKLEEN	Screen cleaner for drilling tar sands							1			
SILDRIL EPL	Silicate-base extreme pressure lubricant		•	•	•			5-8%	N	N	
SIL-LUBE	Lubricant for SILDRIL system		•		•			1-3%	N	N	
STARGLIDE	Lubricant for WBMs	•	•	•	•			1-3 vol%			
STAR-LUBE	Brine Lubricant			•				2 vol%			
STEEL LUBE EP	Extreme-pressure lubricant	•	•	•	•			1-3 vol%			
ULTRAFREE	ROP Enhancer for the ULTRADRIL system	•		•	•			1-2 vol%			
ULTRAFREE L	Low-cost anticrete		•	•	•			1-2 vol%			
ULTRAFREE NH	Non-hydrocarbon version of ULTRAFREE		•	•	•			1-2 vol%			
VERSALUBE	Oil-soluble lubricant					•	•	1-3 vol%		N	N
NEWPARK DRILLING FLUIDS											
TOPSPOT	Non-toxic organic blend	•	•	•	•						Y
DYNAFREE	Blend of lubricants and surfactants	•	•	•	•						Y
DYNAVERT SFT	One-sack blend of emulsifiers and gellants	•	•	•	•						
NOV FLUIDCONTROL											
ECO-SPOT	Environmentally safe spotting fluid	•	•	•	•						Y
ENVIRO-SLIK	Pipe-on-pipe lubricant for brines										
FRICTION-EZE	General purpose drilling lubricant										
HDL Plus	Premium drilling lubricant										
DL-100	Premium drilling lubricant										
PIPE-FILM H	Pipe-on-pipe lubricant for brines										
STIK-FREE	Diesel-based spotting fluid										

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
STIK-FREE W	Diesel-based spotting fluid with viscosifier										
STIK-FREE ECO	Environmentally friendly spotting fluid										
STIK-FREE ECO W	Environmentally friendly spotting fluid with viscosifier										
STRES-FREE	Friction reducer for brines and freshwater										
ULTRA-BEADS CP	Copolymer beads										
ULTRA-BEADS G	Glass beads										
TRAXX TC	Metal Adhereing Lubricant	•	•	•	•						Y
OLEON N.V.											
RADIAGREEN EBL	Env. friendly ester based lubricant	•	•	•	•			1-3%	Y	N	Y
RADIAGREEN EBO	General purpose lubricant & ROP enhancer	•	•	•	•	•	•	4-6%	Y	N	Y
RADIAGREEN EME SALT	Lubricant for heavy brines	•	•	•				1-3%	Y	N	Y
RADIAGREEN SL	Lubricant for pH system >10	•	•	•				2-5%	Y	N	Y
Drilling Lube	Lubricant for OBM					•	•	1-4%	Y	N	Y
TURBO-CHEM INTERNATIONAL											
TURBO-LUBE	Lubricant	•	•	•	•	•		2%			Y
SURFACTANTS											
ADM EVOLUTION CHEMICALS											
ADM 2100	Low viscosity "Green" emulsifier, lubricity enhancer, wetting agent					•	•	0.25-2			Y
ADM 750	"Green" surfactant, lubricity enhancer, wetting agent, secondary emulsifier	•	•	•	•			0.25-2			Y
ADM 3100	Low viscosity "Green" surfactant/lubricity enhancer, wetting agent, secondary emulsifier	•	•	•	•			0.25-2			Y
AES DRILLING FLUIDS											
BLUE MAX	Drilling Detergent / Surfactant	•	•	•	•	•	•				
ENERPLUS	Liquid PHPA	•	•	•	•						
DRILLING DETERGENT	Multi-purpose detergent for water based fluids	•	•	•	•						
BAKER HUGHES DRILLING FLUIDS											
AMPLI-FOAM FW	Freshwater foaming agent				•			1-2 gal/10 bbl			
AMPLI-FOAM SW	Saltwater foaming agent			•				1-2 gal/10 bbl			
BAKER CLEAN 5	WB casing cleaning system for removal of WB and OBM contaminants.							80-100 L/m^3	Gold		
BAKER CLEAN 6	A casing cleaning system and stabilizer for Baker Clean 5 in a viscosified system							60-80 L/m^3	E		
BIO-COTE	Wetting agent for synthetic systems					•	•	2.4-24 L/m^3	Y		
CLAY-COTE HT	Wetting agent and secondary emulsifier					•	•	0.25-2 ppb			
MD	Biodegradable drilling fluid detergent	•	•	•	•	•		.02-.04 gal/bbl	Gold		
MD-II	Biodegradable drilling fluid detergent	•	•	•	•	•		.02-.04 gal/bbl			
MICRO-PRIME	OBM Displacement System		•		•						
MIL-CLEAN	Water-soluble, biodegradable detergent/rig wash	•	•	•	•	•	•	1%			
MIL-CLEAN E	Biodegradable cleaner/degreaser	•	•	•		•	•	1%			
MIL-CLEAN SEA	North Sea approved rig wash detergent		•		•			1%			
MICRO-CURE E2	Mesophase remediation for cased holes	•				•	•	100%			
MUL-FREE RS	Non-emulsifying surfactant							0.25-0.75%	Gold		
NOMUL Z	Non-emulsifier for calcium / zinc brines							0.5-1.0 vol %			
OMNI-COTE	Wetting Agent all emulsion fluids	•				•	•	0.1-1 gal/bbl	Y		
PACK-MUL	Wetting agent for OMNI-PACK system					•	•	6-10 ppb			
PRIME 100	Wellbore OBM displacement additive	•				•	•	10-30%			
PRIME 770	Wellbore OBM displacement additive	•				•	•	10-30%			
PRIME 200HT	Wellbore cleaning product for high temperature displacements				•	•		Varies			
ULTRA FLUSH	Weightable WBM/OBM casing wash				•	•	•	•	As needed			
WELL WASH 100	Casing wash for water-based fluids				•	•			2-20%			
WELL WASH 120	Casing wash for water-based fluids				•	•			2-20%			
WELL WASH 2020	OBM Displacement fluid	•			•	•	•	•	10-20%			
BAROID FLUID SERVICES											
AKTAFLO-S	Non-ionic surfactant	•	•	•	•			0.5-7.0			Y
AQUATONE-S	Non-ionic surfactant	•	•	•	•			0.5-7.0			Y
BARAKLEAN	Degreaser and oil mud remover							As needed			Y
BARAKLEAN FL	Wellbore cleaner for displacement							5% in H_2O			Y
BARAKLEAN FL PLUS	Wellbore cleaner for displacement							5% in H_2O	Y		Y
BARAKLEAN GOLD	Wellbore cleaner for displacement							5% in H_2O	Y		Y
BARAKLEAN NS PLUS	Wellbore cleaner for displacement							5% in H_2O	Y		Y
N-FLOW BREAKERS	Delayed, in-situ filter-cake breakers	•	•	•	•	•	•	As needed	Y		Y
CON DET	Mud detergent	•	•	•	•			0.25-1.0			Y
CON DET E	Surfactant blend	•	•	•	•			0.25-1.0			Y
DHT FOAM	Foaming agent							0.02-2.0%			
DRILFOAM	Foaming agent							0.1-1.0%			Y
DRILTREAT	Oil wetting agent					•		0.25-2.0	Y	Y	Y
EXTENSOL	Salt crystal growth inhibitor				•			0.2-0.5			
PIPESCRUB	Pipe dope remover							As needed			Y
QUIK-FOAM	Foaming agent							0.02-2.0%			Y
CRODA											
MULTIWET MO-70	Wetting agent		•	•	•			0.01-1.0%			
SPAN 80	Oil Spill Dispersants					•	•	40-60%			
SYNPERNONIC LF/RA 320	High temperature Low foam wetting agent		•	•	•			0.01-1.0%			
TWEEN 80	Oil Spill Dispersants	•	•	•	•			40-60%			
TWEEN 85	Oil Spill Dispersants	•	•	•	•			40-60%			
Brij L23	Foamer		•		•			0.25-2.0%			
CrodaDrill E10	Non-ionic Emulsifier for oil-based muds					•		System based			
CrodaDrill WA10	Wetting agent, emulsifier and inverter for oil-based muds				•	•	•	0.05-0.2%			
Crodafos T6A	Foamer		•		•			0.25-2.0%			
Crodasinic LS30	Foamer		•		•			0.25-2.0%			
Crodateric CAS50	Foamer		•		•			0.25-2.0%			
Crodateric LIDP	Foamer		•		•			0.25-2.0%			
HYPERMER B-246	E for oil-based muds					•		0.25-2.0%			
INCROMIDE 716	Foam stabilizer	•	•	•			•	0.25-2.0%			
INCROMIDE CMEA	Foamer							0.25-2.0%			
Multitrope 1620	Foamer		•		•			0.25-2.0%			
NatSurf 125	Demulsifier Surfactant for wellbore clean-up				•	•		1-3%			

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
PRIFER 6813	Environmentally friendly solvent (d-limonene replacement)					•		10-100%			
Span 20	Non-ionic Emulsifier for oil-based muds				•	•	•	0.2-1.0%			
Synperonic 13/6	Demulsifier Surfactant for wellbore clean-up				•	•		0.2-1.0%			
SYNPERONIC A11	Wetting agent				•	•		0.01-1.0%			
SYNPERONIC LF/RA 280	Environmentally friendly low foaming wetting agent				•	•		0.5-2.0%			
SYNPERONIC LF/RA 310	Environmentally friendly low foaming wetting agent				•	•		0.5-2.0%			
SYNPERONIC NCA 850	Environmentally friendly low foaming wetting agent				•	•		0.01-1.0%			
Tween 20	Foamer		•		•			0.5-2.0%			
LAMBERTI SPA											
ALBISOL AT	Cleaner/spacer	•	•	•	•	•	•	2-10%			
ALBISOL DM	Washer/spacer	•	•	•	•	•	•	2-10%			
ALBISOL F10	Environmental friendly mud remover – direct emulsifier	•	•	•	•	•	•	2-10%			Y
ALBISOL K100	Cleaner/Spacer for grease residues	•	•	•	•	•	•	2-10%			
ALBISOL OE	Solvent based pipe cleaner					•		2-10%			
DRILTAL DK	Anti sticking / Anti bit balling	•	•	•	•			1-3			
DRILTAL 131	Anti bit balling agent / cleaner	•	•	•	•			1-10			
FOAMEX SAL	Salt tolerant foaming agent	•	•	•	•			1-10			
FOAMEX TX	Concentrate forming agent	•	•		•			0.5-5			
M-I SWACO											
CLEAN UP	Surfactant blend	•	•	•	•	•	•	1-100%	N	N	
D-D	Drilling detergent	•	•	•	•			0.5-6	N	N	Y
D-SPERSE	Surfactant			•				0.25-1 vol%			
DEEPCLEAN	Solvent/surfactant wash chemical O/SBM					•	•	5-20%	Y	Y	Y
DEEPCLEAN NS	Solvent/surfactant wash chemical O/SBM					•	•	5-20%	Y	Y	
DRILFREE	Lubricant, anti-sticking agent	•	•	•	•			1-3%	Y	N	
DRIL-KLEEN	Low-toxicity detergent	•	•	•	•			0.2-1	N	N	Y
DRIL-KLEEN II	Anti bit balling agent	•	•	•	•			0.2-0.5	N	N	
DRILZONE	ROP enhancer	•	•		•			1-2 vol%			
DRILZONE L	Low-cost anticrete	•	•		•			1-2 vol%			
DRILZONE NS	ROP enhancer	•	•		•			1-2 vol%			
DRILZONE II	ROP enhancer	•	•		•			1-2 vol%			
ECOGREEN P	Primary emulsifier						•	2-6	Y	N	
ECOGREEN S	Secondary emulsifier						•	2-6	Y	N	
ECOKLEEN	Anticrete for tar applications										
ENVIROBLEND	Salt for ENVIROVERT system					•					
FAZE-OUT	Delayed breaker system for FAZEPRO system					•		System			Y
FAZE-MUL	Emulsifier for FAZEPRO System						•	8-12	N	N	
FAZE-WET	Wetting agent for FAZEPRO system						•	8-12	N	N	
FLOWBAK	Non-Ionic Surfactant - Flowback Enhancer				•	•					
GLYDRIL DG	Water-miscible glycol hydrate inhibitor	•	•	•	•			3-20%	N	N	
HYDRABLOK	Deepwater hydrate inhibitor	•	•	•	•			5 vol%			
KLEEN UP	Surfactant cleaner					•	•				
LUBE-167	Low-toxicity lubricant	•	•	•	•			4-16	Y	N	Y
M-I 157	Supplemental emulsifier						•	0.5-2	N	N	
MUD WASH	Rig wash							2-10 vol%			
NOVAMUL	Primary emulsifier and wetting agent for synthetic fluids						•	2-8	N	N	Y
NOVATHIN	Thinner for synthetic muds						•	0.5-2	N	N	Y
NOVAWET	Wetting agent for synthetic muds						•	1-5	N	N	Y
NOVAWET CN	Capped wetting agent						•				
NOVAWET PLUS	Capped wetting agent						•				
PARAWET	Wetting agent for OBM & SBM						•	1-5			
PEN-X	Surfactant - OB Filtercake Dispersion						•				
SAFE-SOLV E	Pipe dope pickle solvent						•	2-20%	Y	N	
SAFE-SOLV OM	Dispersible solvent for OBMs and SBMs						•	2-20%	N	N	
SAFE-SURF E	Non-ionic wellbore cleaning agent for OBM and WBM	•	•	•	•	•	•	2-15 vol%			
SAFE-SURF NS	Wash chemical						•	5-20 vol%			
SAFE-SURF O II	Displacement wash chemical for WBM	•	•	•	•			1-10%	N	N	
SAFE-SURF W	Surfactant-base detergent	•	•	•	•			2-10%	N	N	
SAFE-SURF WN	Displacement wash chemical for WBM	•	•	•	•			2-10%	N	N	
SAFE-T-PICKLE	Pipe dope solvent	•	•	•	•			1			
SCREENKLEEN	Stops screen blinding from tar & heavy oil	•	•	•	•			0.5-1 vol%			
SUREMUL	Primary emulsifier for synthetic systems						•	2-8	N	N	Y
SUREMUL EH	Non-dispersive emulsifier for SBM						•	2-8			
SURETHIN	Thinner for synthetic systems						•	0.5-2	N	N	Y
SUREWET	Wetting agent for SBM systems						•	1-5	N	N	Y
SWA EH	OBM wetting agent for high-brine-content systems					•		1-5	N	N	
TARLIFT	Solvent for the SAGDril system				•			0.1-2 vol%			
TARSURF	Water-wetter for the SAGDril system				•			0.02-0.5 vol%			
ULTRAFREE	ROP enhancer for ULTRADRIL system		•	•	•			1-2 vol%			
ULTRAFREE L	Low-cost anticrete		•	•	•			1-2 vol%			
ULTRAFREE NH	Non-hydrocarbon version of ULTRAFREE		•	•	•			1-2 vol%			
ULTRAFREE NS	ROP enhancer for WBM			•	•			1-2 vol%			
ULTRAFREE II	ROP enhancer for ULTRADRIL system			•	•			1-2 vol%			
VERSACOAT	Wetting agent & emulsifier					•		1-8	N	N	
VERSACOAT HF	Emulsifier for OBM					•		1-8	N	N	
VERSACOAT NA	High flash point emulsifier for oil muds					•		1-8	N	N	
VERSATRIM	Reduces oil on cuttings for OBM					•		2-6			
VERSAWET	Wetting agent for OBM					•		1-6	N	N	
NOV FLUIDCONTROL											
DE-2000	ROPenhancer				•	•		55/100			
CLEAR-BREAK	Demulsifier										
CLEAR-BREAK W	Water clarifier										
SURF-FREE	Surfactant										
SURF-FREE CB	Surfactant										
PERM-CON	Demulsifier										
HME	Surface active agent	•	•	•	•						
TENSION-EZE	Drilling mud detergent	•	•	•	•			0.1-0.4			Y

Product name	Description	Dispersed	Nondispersed	Saturated salt	Fresh water	Oil-based	Synthetic fluid	Normal concentration usage (lb/bbl)	HOCNF classification	Plonor listing available	Passed LC50 test
OLEON N.V.											
RADIAGREEN CLO	Stimulation additive & mud cake breaker					•	•				
RADIAGREEN CLW	Cased hole cleaner	•	•	•		•	•				
THINNERS/DISPERANTS											
AES DRILLING FLUIDS											
AES SPERSE	Dispersant/thinner for all oil based drilling fluids					•	•				
ENER SPERSE	Oil mud dispersant for ENERREACH system					•	•				
BAKER HUGHES DRILLING FLUIDS											
ALL-TEMP XPR	Economy water-base deflocculant/ rheological stabilizer	•	•	•	•			.25-1 ppb			
LIGCO	Ground leonardite	•			•			2-8 ppb			Y
LIGCON	Ground causticized leonardite	•			•			2-8 ppb			Y
MIL-TEMP	Contamination-resistant HPHT rheological stabilizer for WBM, > 500°F	•	•	•	•			1-2 ppb	Y		
NEW-THIN	Synthetic deflocculant	•	•	•	•			0.14 L/m³			Y
UNI-CAL	Chrome-modified sodium lignosulfonate	•		•	•			2-6 ppb	Y		
UNI-CAL CF	Chrome-free lignosulfonate	•	•	•	•			1-5 ppb	Y		
BAROID FLUID SERVICES											
ATC	All temperature thinner						•	1.0-3.0			Y
BARAFOS	Sodium polyphosphate compound		•					0.1-1.0			Y
BARATHIN-PLUS	Modified lignosulfonate	•	•	•	•			2.0-6.0			Y
CARBONOX	Leonardite	•	•	•	•			2.0-12.0	Y	Y	Y
COLDTROL	Cold temperature thinner						•	1.0-3.0			Y
DEEP-TREAT	Wetting agent					•	•	1.0-6.0			Y
ENVIRO-THIN	Chrome-free lignosulfonate	•	•	•	•			2.0-6.0	Y	Y	Y
IRON-THIN	Iron lignosulfonate	•	•	•	•			2.0-6.0			Y
LIGNOX PLUS	Lignosulfonate thinner for lime muds		•					2.0-10.0			
OMC	Oil mud conditioner					•	•	.25-1.5			
OMC 42	Oil mud conditioner					•	•	.25-1.5	Y		Y
OMC 2	Oil mud conditioner					•	•	0.1-0.5			Y
OMC 3	Oil mud conditioner					•	•	0.1-1.0	Y		
QUIK-THIN	Ferrochrome lignosulfonate	•		•	•			1.0-8.0			Y
QUIK-THIN PLUS	Chrome lignosulfonate	•	•	•							
SAPP	Sodium acid polyphosphate	•			•			0.1-0.5	Y	Y	
THERMA-FLOW 500	High temperature dispersant	•	•					1-4 vol%			Y
THERMA-THIN	High temperature deflocculant	•	•	•	•			0.1-4.0	Y		Y
CRODA											
HYPERMER 2296	Polymeric dispersant for oil-based systems					•	•	1-3%			
HYPERMER 2524	Polymeric dispersant for oil-based systems					•	•	1-3%			
KEMELIX 7475X	Polymeric dispersant for oil-based systems					•	•	0.02-0.2%			
CrodaDrill T20	Dispersant for organics and polymers (Rheology modifier)					•	•	1-3%			
ZEPHRYM PD 7000	Dispersant for water-based systems	•	•	•	•			0.2-2.0%			
ZEPHRYM SD 1121	Anionic dispersant for water-based systems	•	•	•				0.2-2.0%			
DRILLING SPECIALTIES CO.											
CF DESCO DEFLOCCLANT	Chrome free modified tannin	•	•	•	•			0.25-6		Y	Y
CF DESCO II DEFLOCULANT	Chrome free modified tannin	•	•	•	•			0.25-6		N	Y
DESCO DEFLOCCULANT	Modified tannin	•	•	•	•			0.25-6		Y	Y
DRILL-THIN THINNER	Chrome free modified tannin	•	•	•	•			0.25-6		Y	Y
ELKEM AS, MATERIALS											
ESM D2	Deflocculant for Micromax	•	•	•	•			0.75-4.5	Y	Y	Y
LAMBERTI SPA											
EMULAM ASB	Super wetting agent for OBM					•	•	0.5-3			
EMULAM HP120	High efficiency thinner/dispersant for OBM					•	•	0.5-3			
LAMSPERSE 100	Liquid polyacrylate based, synthetic thinner - chrome free	•	•		•			0.2-3			Y
LAMSPERSE 300	Liquid calcium tolerant synthetic copolymer for HT	•	•		•			0.2-2			Y
LAMSPERSE TH II	Chrome free powder thinner for HT	•		•	•			0.2-3			
RHEOMATE	Liquid zirconium complex, thinner / stabilizer for HT conditions	•	•		•			.05-5			Y
M-I SWACO											
CAUSTILIG	Causticized ground lignite	•		•	•			1-15	N	N	Y
CALOTHIN HT	ENVIROTHERM system Thinner	•	•		•			2-6			
CALOSPERSE	ENVIROTHERM system Thinner	•	•	•	•			4-16			
CALOSPERSE ZR	ENVIROTHERM system Thinner	•	•	•	•			4-16			
IDSPERSE XT	High temp polymeric dispersant	•	•	•				1-6	Y	N	
K-17	Potassium causticized lignite	•	•	•	•			1-15	N	N	Y
NOVATHIN	Thinner for synthetic muds						•	0.5-2	N	N	Y
NOVAWET	Wetting agent for synthetic muds						•	1-5	N	N	Y
PTS-200	Polymeric temperature stabilizer	•	•	•				2-5			
PTS-530	Alkalinity control agent	•	•	•	•			0.1-1 vol%			
RESINEX	High-temperature synthetic resin	•	•	•	•			2-6	N	N	Y
RESINEX II	High-temperature synthetic resin	•	•	•	•			2-10	N	N	Y
RHEDUCE	Thinner and conditioner for the RHELIANT system						•	0.1-0.2			
RHEOCHEK	Chrome-free lignosulfonate	•		•	•			1-12			
RHEOSPERSE	Polymeric high-temperature deflocculant	•	•		•			1-5	N	N	
SHALE CHEK	Shale control & gumbo additive	•	•	•	•			5	N	N	
SPERSENE	Chrome lignosulfonate	•		•	•			1-12	N	N	Y
SPERSENE CFI	Iron lignosulfonate	•		•	•			1-12	N	N	
SPERSENE I	Ferrochrome lignosulfonate	•		•	•			0.5-8	N	N	Y
SURETHIN	Thinner for synthetic RDF systems						•	0.5-2	N	N	Y
SUREWET	Wetting agent for syn. RDF systems						•	1-5	N	N	Y
TACKLE	Sodium polyacrylate	•	•		•			0.1-1	N	N	Y
TACKLE DRY	Dry sodium polyacrylate	•	•		•			0.1-2	N	N	
TANNATHIN	Ground lignite	•	•	•	•			1-15	N	N	Y
THI-2000	Hardness indicator			•							
THINSMART	Organic FCA and rheological additive	•	•	•	•			1-6			
VERSATHIN	Surfactant thinner for high-solids OBM					•		0.5-2	N	N	
VERSATHIN HF	Version of VERSATHIN made with VERSACOAT HF					•		0.5-2	N	N	
XP-20 N	Chrome lignite, neutralized	•	•	•	•			1-15	N	N	
XP-20K	Potassium causticized chrome lignite	•	•	•	•			1-15	N	N	Y
NEWPARK DRILLING FLUIDS											
DYNADET	Detergent	•	•	•	•			0.1-3			Y
EVOCON	Fluid conditioner	•	•	•	•			0.1-2			Y
FLEXTHIN HTZ	High-temperature thinner	•	•	•	•			0.5-10			Y
GAGECON	Anion surpressor		•		•			0.1-4			Y
NEWFLOW	Ferrochrome lignosulfanate	•	•	•	•			2-5			Y
NEWLIG	Lignite	•	•	•	•			2-10			Y
NEWSTABIL	Fluid stabilizer	•	•	•	•			0.1-6			Y
OPTICLEAN	Blend of surfractants					•					
NewEdge	Fluid conditioner and fluid loss reducer	•	•	•	•			2-10			
NOV FLUIDCONTROL											
LIQUI-THIN	Polymeric deflocculant	•	•	•	•			1-4			Y
CHEMSPERSE	Chrome lignosulfonate	•		•				2-6			Y
CHEMSPERSE CF	chrome-free n lignosulfonate	•		•				2-6			Y
CHEMTEMP	high temp degeller										
ECO-SPERSE	Modified lignosulfonate	•	•	•	•			0.25-5			Y
ECO-SYN Thin	thinner for synthetic based drilling fluids										
MAX-SPERSE	chrome tannin										
MAX-SPERSE CF	chrome-free tannin										
PETRO-THIN	thinner for diesel based drilling fluids										
NOV LIG	Processed lignite	•	•	•	•			6			Y
SAPP	Sodium acid pyrophosphate	•			•			0.1-0.25			Y
TURBO-CHEM INTERNATIONAL											
E Z THIN	Surfactant blend to maintain pumpability & fluidity of E Z Squeeze	•	•	•	•	•	•	5.6 lbs/bbl			Y
WEIGHTING AGENTS											
AES DRILLING FLUIDS											
BARITE	Barite, API Spec for raising fluids mud weight	•	•	•	•	•	•				
BAKER HUGHES DRILLING FLUIDS											
AMMONIUM CHLORIDE	Solid salt for NH_4Cl fluids to 9 ppg			•	•			As needed	E	Y	
CALCIUM BROMIDE	Solid salt for 15.3 ppg			•				As needed	E	Y	
CALCIUM CHLORIDE	Solid salt for 11.6 ppg			•				As needed	E	Y	
DEEP SWEEP	Coarse ground barite to improve hole cleaning	•	•	•	•	•	•				
HEMATITE	Iron oxide	•	•	•	•	•	•	As needed	E	Y	
MIL-BAR	Barite meeting API specifications	•	•	•	•	•	•	As needed	E Pb, Zn	Y	
MIL-BAR 410	Barite with 4.1 specific gravity	•	•	•	•	•	•	As needed	Y	Y	
MIL-BAR NA	Barite with 4.0 specific gravity	•	•	•	•	•	•	As needed	Y	Y	
MIL-BAR UF	Ultra fine grind barite	•	•	•	•	•	•	As needed	E	Y	
POTASSIUM CHLORIDE	Solid salt for NoCal fluids to 9.7 ppg			•				As needed	E	Y	
POTASSIUM FORMATE	Dry KCOOH for weight up to 13.1 ppg			•					E	Y	
SODIUM BROMIDE	Powder for NoCal fluids to 12.7			•				As needed	E	Y	
SODIUM CHLORIDE	Solid salt for fluids to 10 ppg			•				As needed	E	Y	
SODIUM FORMATE	Dry NaCOOH for weight up to 11 ppg			•					E	Y	
W.O. 30	Sized, ground calcium carbonate (Multiple grind sizes available)	•	•	•	•	•	•		E		
BAROID FLUID SERVICES											
BARACARB 5, 25, 50,150, 600	Sized calcium carbonate	•	•	•	•	•	•	5.0-60.0	Y	Y	Y
BARAPLUG 20, 50, 6/300	Sized salt	•		•				As needed	Y	Y	Y
BARAWEIGHT	Iron carbonate powder	•	•	•	•	•	•	As needed			Y
BARODENSE	Hematite	•	•	•	•	•	•	As needed			Y
BAROID	Barite	•	•	•	•	•	•	As needed	Y	Y	Y
BAROID 41	4.1 specific gravity barite	•	•	•	•	•	•	As needed	Y	Y	Y
BAROID F10	10 micron average diameter barite								Y	Y	Y
HEMATITE	Iron oxide	•	•	•	•	•	•	As needed			Y
SWEEP-WATE	Selectively sized barite for sweeps	•	•	•	•	•	•	As needed	Y	Y	Y
CHEMTOTAL											
BAR-TITE	API Barite	•	•	•	•	•		10-60			Y
ELKEM AS, MATERIALS											
MICROMAX	Microfine weighting agent (Mn3O4)	•	•	•	•	•	•	As needed	Y	Y	Y
MICRODENSE	Micronised ilmenite	•	•	•	•	•	•	As needed	Y	Y	Y
MAXFORM	Micromax in Pot Formate Slurry	•	•					As needed	Y	Y	Y
M-I SWACO											
FER-OX	API hematite	•	•	•	•	•	•	1-500	Y	Y	Y
FLO-WATE	Sized salt			•				40-60		N	N
LO-WATE	Sized ground limestone	•	•	•	•	•	•	10-40		N	Y
M-I BAR	API barite	•	•	•	•	•	•	1-600	Y	Y	Y
M-I WATE	4.1 sg barite	•	•	•	•	•	•	1-600	N	N	
SAFE-CARB	Sized ground marble	•	•	•	•	•	•	10-50		Y	N
WARP	Micron-sized weighting agent	•	•	•	•	•	•	System			
NOV FLUIDCONTROL											
CALCIUM BROMIDE	Salt			•	•			As needed			
CALCIUM CHLORIDE	Salt			•	•			As needed			
HEMATITE	Hematite	•	•	•	•	•	•				Y
NOV BAR	Barite	•	•	•	•	•	•				Y
NOV CARB C	Calcium carbonate	•	•	•	•			As needed			
POTASSIUM CHLORIDE	Salt			•	•			As needed			
SODIUM BROMIDE	Salt			•	•			As needed			
SODIUM CHLORIDE	Salt			•	•			As needed			
TURBO-CHEM INTERNATIONAL											
E Z THIN	Surfactant blend to maintain pumpability and fluidity of E Z Squeeze	•	•	•	•	•	•	5.6 lbs/bbl			Y

Footnotes: PLONOR status only given for materials registered for use in the North Sea

Lagos base targeting major increase in local content for Egina topsides

Jeremy Beckman
Editor, Europe

Nigeria's first purpose-built deepwater logistics base and offshore fabrication yard is preparing for the country's next wave of developments involving giant FPSOs. Under a joint venture with Samsung Heavy Industries, LADOL has started building topsides modules for Total's Egina FPSO, with the completed hull due to arrive from South Korea for integration works at LADOL late in 2016. This will be the first-ever floater part-built and integrated onshore in Nigeria.

The JV, known as SHI-MCI Free Zone Enterprise, is operating from the LADOL Free Zone at Apapa Port on a peninsula at the point of entry to Lagos Harbor. Work on the LADOL complex started in 2001: during the first phase, newly formed and privately owned Lile began the $100-million development of Nigeria's first privately financed logistics and engineering base, designed to provide deep offshore operations support for drilling and production and construction projects to the major oil companies, as well as round-the-clock services such as rig and offshore vessel repairs.

As Dr. Amy Jadesimi, managing director of LADOL pointed out, the country's established offshore engineering/logistics centers at Warri and Port Harcourt are more geared up to serve shallow-water projects in the Delta region, whereas Lagos is much closer to Nigeria's deepwater blocks. "Deep offshore requires a totally different business model," she said. "It also helps that we are 100% privately funded and 100% Nigerian, which means we don't have any other focus other than on delivering our business and growing the size of the market."

Under the older business models, oil companies were obliged to favor contractors on good terms with the government, Jadesimi noted. "Previously, if they tried to integrate an FPSO while working with a Nigerian company that was not a fabrication specialist, they ended up having to complete the work outside the country. It's better to have a qualified indigenous company to do this work – but we first had to prove to all the stakeholders that we could do it in-country, and that our operation would add value to the oil industry."

In 2007, LADOL's founders decided the Phase 2 development would be a fabrication/integration facility. "That was when Shell attempted to launch the Bonga Southwest project for the first time," Jadesimi added. "Heerema was going to be our technical partner: they felt we had the optimal location. Bringing an FPSO onshore anywhere in Africa is risky, because if the hull ends up damaged, it has to go back to the construction yard in the Far East. However, the location we have here is geographically ideal, having wide, deep access and being close to the shipping lane."

Buoy under construction at LADOL. (Image courtesy LiLE)

Impetus for the new $300-million FPSO facility re-started in 2011 when Total launched tenders for its Egina development in Oil Mining Lease 130, around 130 km (81 mi) offshore, calling for a 200,000 b/d production vessel with 2.3 MMbbl of crude storage capacity. A year earlier, the government had passed new legislation that mandated the development of FPSO integration capability in-country in order to boost local content in oil and gas projects. Hyundai Heavy Industries and Samsung both bid for the Egina FPSO contract on the basis of providing an onshore integration solution, but Jadesimi said that Samsung's strategy with LADOL came across as the most realistic plan.

For this project Samsung is in charge of all fabrication and integration, also supplying the managing director of the joint venture, with the second person in command from LADOL. The Free Zone, which covers 100 ha, has set aside a 20-ha (20,000-sq m) area for integration works. Fabrication started at the yard last month. The design and operation of the yard matches that of the facilities and production processes at Samsung's offshore construction complex on Geoje Island, South Korea, right down to the planned new 500-m (1,640-ft) long, quay wall, designed to provide 25 tons/sq m load-bearing capacity (in addition to the existing 200-m/656-ft long quay wall already at LADOL).

The original target was to fabricate 14,000 tons of modules for the Egina topsides in Nigeria (some at LADOL and the balance at other yards across Nigeria), with integration continuing at the site for a year after the FPSO hull arrives. Aside from this project, the investment is intended to ensure that the facility (and Nigeria) is capable of building more new FPSOs, as well as refurbishing old ones, for the next 30 years, Jadesimi added.

The country's next major deepwater project, Bonga Southwest, has an in-country fabrication target of around 20,000 tons, and this could be followed by ExxonMobil's Bosi, based on a new or refurbished FPSO. However, as things stand, Jadesimi noted, Nigeria does not have this fabrication capacity.

"Nigeria's local content for projects has been stuck at around 10% for decades," she observed. "But we are now realistically targeting 70%, since the FPSO will be integrated in-country. The demand exists, which means quadrupling fabrication and engineering facilities across the country. For this to happen, there needs to be more discussion of what our education system is producing, and the government needs to work with industry on developing more targeted training at out technical colleges and higher education schools."

Aside from fabrication/integration, the current Phase 2 program is designed to double LADOL's logistics capability so that it can accommodate several drilling rigs (for repairs) and supply vessels at the same time.

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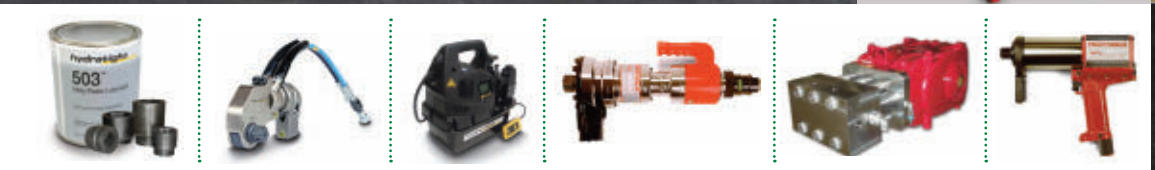

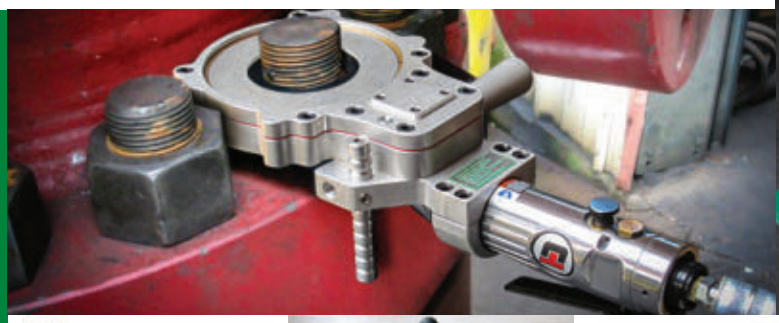
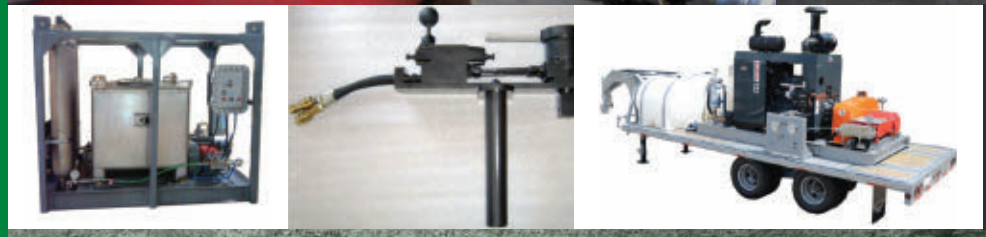

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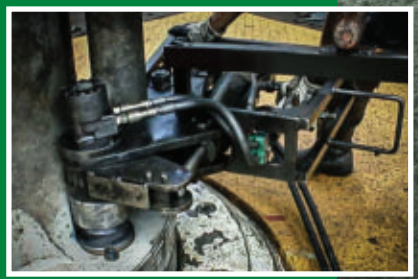

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DeepStar mooring study to form basis of new API RP

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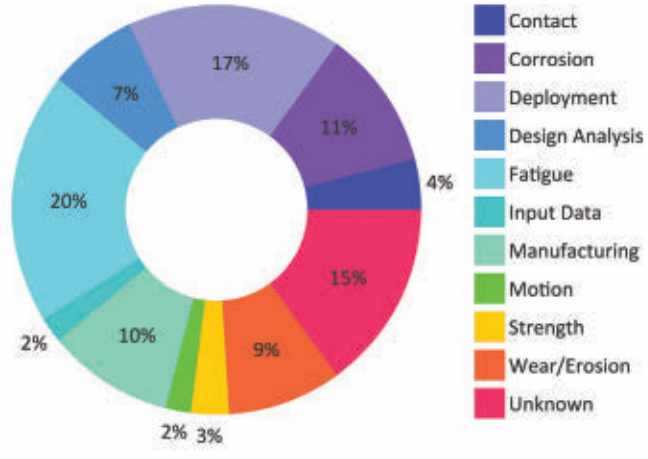
Moorings on floating production units (FPU) are safety critical systems subjected to numerous forms of degradation caused by the harsh ocean environment and more than 20 years of cyclical tension loading. The consequences of a mooring leg failure can be significant. Production may be impacted while replacement mooring leg components are procured and the repairs are implemented. While single line failures can be costly – around $3-15 million – there is a credible risk that multiple line failures could occur in severe weather, which would have significantly graver consequences.

In response to instances of premature mooring line replacement and failure, the DeepStar consortium funded a two-year study beginning in December 2013. The study was performed by the DeepStar Floating Systems Committee and AMOG Consulting.

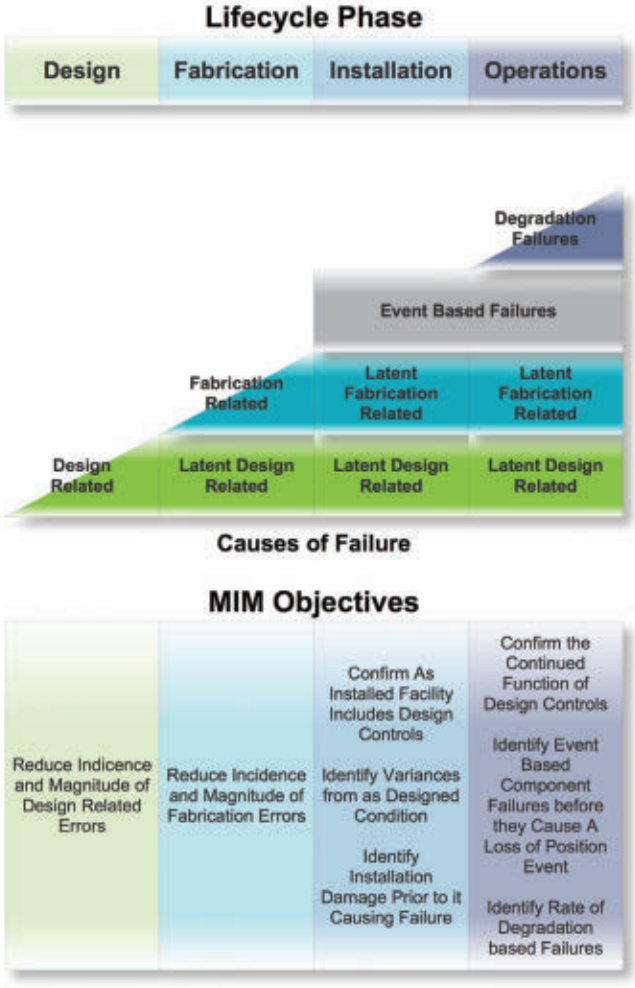
The DeepStar survey of FPU mooring system performance shows that the annual probability of failure for a single mooring line is about 20 times higher than typically assumed in mooring codes. Furthermore, the annual rate of multiple line failure, which can result in severe riser damage, was found to be about 400 times higher than typical code requirements. The mooring failure statistics also show that the industry is currently requiring numerous pre-emptive replacements to avoid failure.

As is apparent from the pie chart depicting the distribution of line failures, fatigue is the leading failure mechanism, but the survey found that many different failure modes have occurred. This illustrates the complexity involved with managing mooring integrity.



Distribution of mooring line failures from the DeepStar survey. (All images courtesy DeepStar)

Mooring integrity management objectives by project phase.



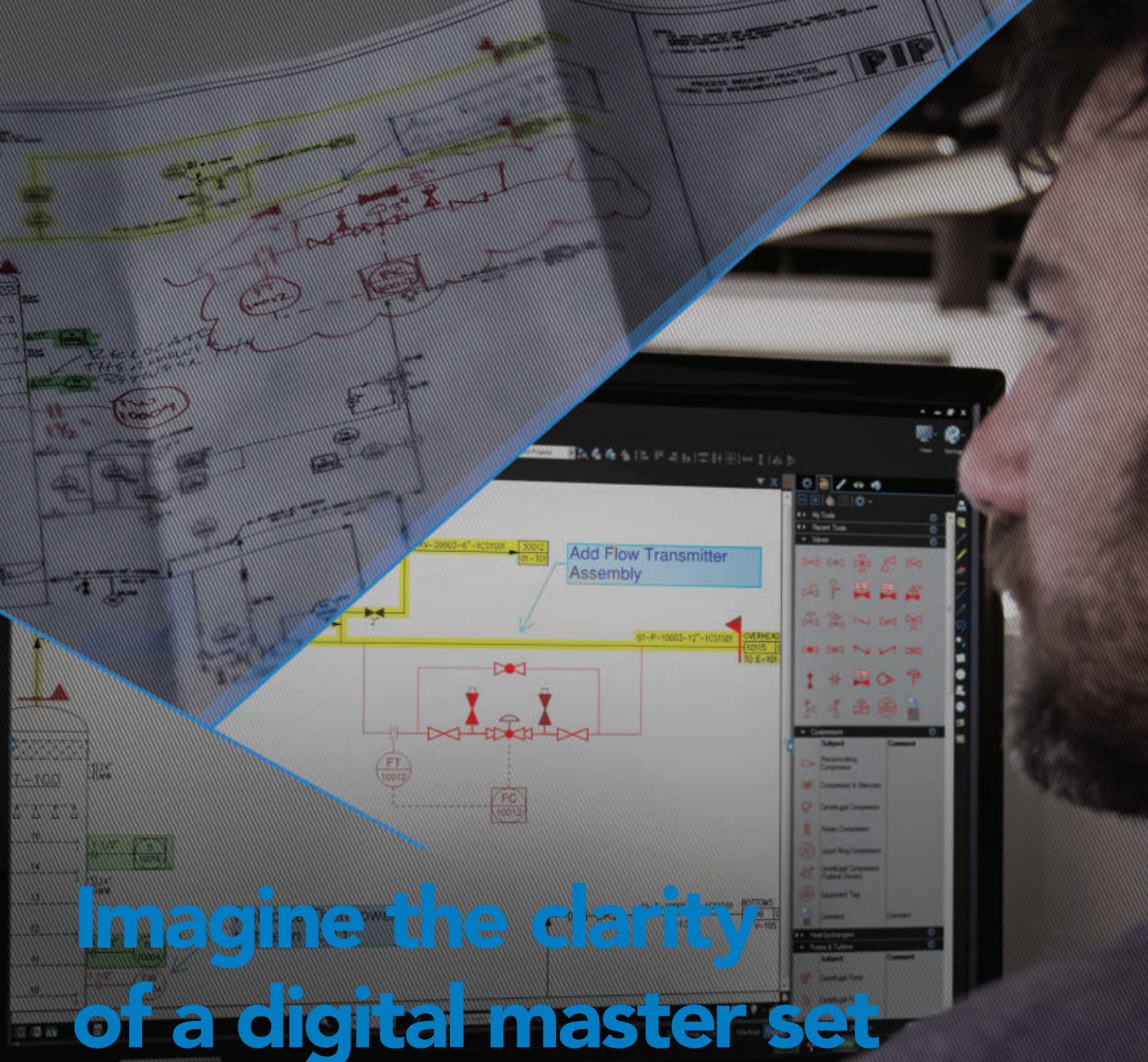
In order for the industry to improve, it is essential that designers and operators fully consider the lifecycle risks and build mooring integrity management (MIM) into their design, operational practices, and associated systems.

The two-year study produced a comprehensive Mooring Integrity Management Guideline (MIMG) for permanent mooring systems.

Managing mooring integrity

The MIMG is designed to readily interface with other elements of an operator's business management system. Additionally, it is intended to be used to develop:

- A mooring system with an acceptable risk of failure
- A detailed understanding of mooring performance characteristics
- A detailed understanding of the possible causes of failure of the mooring system



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- A detailed and specific plan for managing the integrity of the mooring system through its life.

The guideline addresses a number of gaps in current industry guidance. For example, inspection of mooring systems is time-consuming, costly, and can expose the mooring system to potential damage. In response, the MIMG introduces a risk-based inspection (RBI) philosophy in which inspection intervals are based on component criticality. These may be controls that are put in place at design, fabrication, or installation phases. Critical components are identified early in the design process based on mooring line failure statistics and known failures, and are then monitored through the design process into the fabrication, installation, and operations phases.

For RBI to be effective, it is essential that the operator capture deviations or anomalies through the life of the mooring system. Ideally, this is started as early in the design process as possible. However, MIMG principles can be adopted at any stage during the lifecycle of the field development. The RBI approach requires a very good understanding of the possible failure mechanisms for the various mooring components and the controls that can be put in place to reduce the risk.

RBI programs are designed to optimize the number of inspections required to achieve a particular target component reliability. Similarly, the inspection strategy is adapted over time as inspection and degradation data is fed back into the process. However, RBI strategies have greater requirements placed on competency, resource, system knowledge, and background data on failure modes and predicted failure frequencies.

The objective of the MIM process, which is the series of actions or steps taken in order to achieve mooring integrity, is to manage the risk of a loss-of-position event, such as mooring line failure, which can lead to riser failure and hydrocarbon release. It also must consider how to manage the loss-of-position event once it occurs by having the necessary recovery plans in place. Accordingly, an MIM system, which manages the risk of mooring failure, must identify failure modes associated with the four root causes of structural failure:

- Design failures (i.e., the design of the system is inadequate to resist the forces to which it is exposed)
- Fabrication errors (i.e., the system is fabricated incorrectly or from incorrect materials)
- Event-based failures (e.g., the system is exposed to a load for which it was not designed)
- Degradation failures (i.e., the system is allowed to degrade to a point where its capacity to resist its operating and environmental loads is less than as designed.

Additionally, the MIM process has specific objectives at each phase of a mooring's lifecycle.

The MIMG recommends that an integrity management strategy be developed at the front-end engineering or design stage or earlier, and to carry verification activities further through the design and installation stages. Another key item is to consider the need for either planned or unplanned replacement of the mooring system through the design life of the facility. Consideration of these aspects at the design stage can save significant money and time in the operations phase.

New API RP

The American Petroleum Institute (API) has initiated development of its own recommended practice (RP) for MIM. API approached DeepStar to release the MIMG so that it can form the basis for the mooring integrity RP, to which DeepStar agreed. The mooring integrity RP is targeted for release in 2016.

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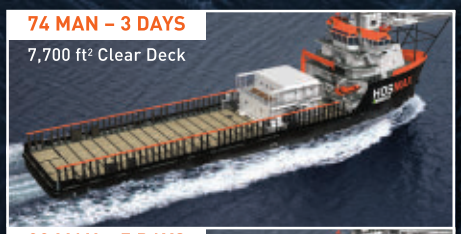

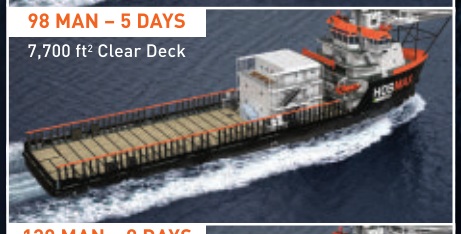

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Composite riser study confirms weight, fatigue benefits compared with steel

Hybrid system could extend drilling water depths

Paul Hopkins
Hassan Saleh
Glen Jewell
2H Offshore

Composite pipe technology can enable the offshore industry to operate in deeper and harsher environments. As composite material products undergo further development and are used more extensively, codes and standards will emerge that detail the rules for their design, testing, and manufacture.

In the past, composite materials have been used extensively in the offshore environment but mainly in secondary structures such as pipework, caissons, J-tubes, riser protection, walkways and ladders. Improvements in structural integrity led to the first composite drilling riser joint, used for testing purposes on the Heidrun platform in the Norwegian Sea in 2001.

More recently composites have been used as downlines to support pre-commissioning and acid stimulation operations. In 2014, a fully composite 3-in. pre-commissioning downline was used repeatedly in a water depth of more than 2,100 m (6,890 ft) offshore Brazil.

Various companies are now scaling up efforts to produce composite pipe for offshore use, including UK-based Magma Global and Dutch manufacturer Airborne Oil & Gas. Both have developed thermoplastic composite pipe products based on a single solid pipe wall built up from layers of polymer and reinforcing fiber matrices.

Pros and cons

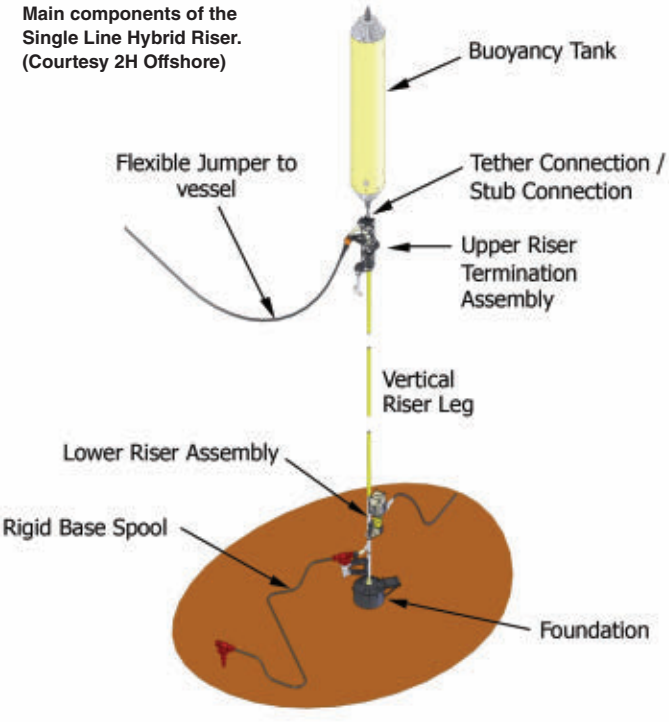
Composite materials offer a range of benefits that could improve riser technology. Composites are lightweight and offer high levels of strength. They can be formed into complex shapes and can provide high levels of resistance to fatigue and corrosion. Maintenance needs are relatively low, and they can be installed via reel lay. They also have a low axial and bending stiffness in comparison to steel.

On the other hand, composites present a high material cost and have a limited track record offshore, despite widespread applications in other industries. Currently, there are few codes and standards with direct applicability to composite risers. Further concerns relate to damage to the sub-laminar which is hard to inspect on a manufactured pipe, and to the challenges of making up connections and end fitting design.

Some of the benefits that composites may bring to the riser industry include:

- Reduced vessel hang-off loads
- Cheaper installation costs (due to lessened weight)
- Lower maintenance requirements
- Low roughness on internal bore (offering increased flow rates).

Despite these benefits, replacing steel with composite materials is unlikely to reduce the costs for existing designs. The real advantage composites offer is as an enabling technology for new concepts and operations in challenging locations and environments.



Main components of the Single Line Hybrid Riser. (Courtesy 2H Offshore)

To assess the potential benefits, 2H Offshore performed a comparison of a deepwater production riser using both steel and composite pipes. The study was designed to ascertain the potential benefits of composite pipe, and does not make a case for an optimized composite riser design.

SLHR overview

The Single Line Hybrid Riser (SLHR) is an established deepwater riser system that has been used extensively around the world. It employs a vertical steel riser section, tensioned by a buoyancy tank, which is connected to the host vessel via a flexible jumper. The concept is also known by other acronyms such as SLOR and FSHR.

The main components are:

- Foundation
- Lower riser assembly (LRA)
- Standard riser joints
- Upper riser termination assembly (URA)
- Buoyancy can and tether/stub connection
- Flexible jumper
- Rigid base spool.

The study considered a conventional SLHR with a steel vertical riser leg and compared it to an equivalent riser with the steel pipe replaced

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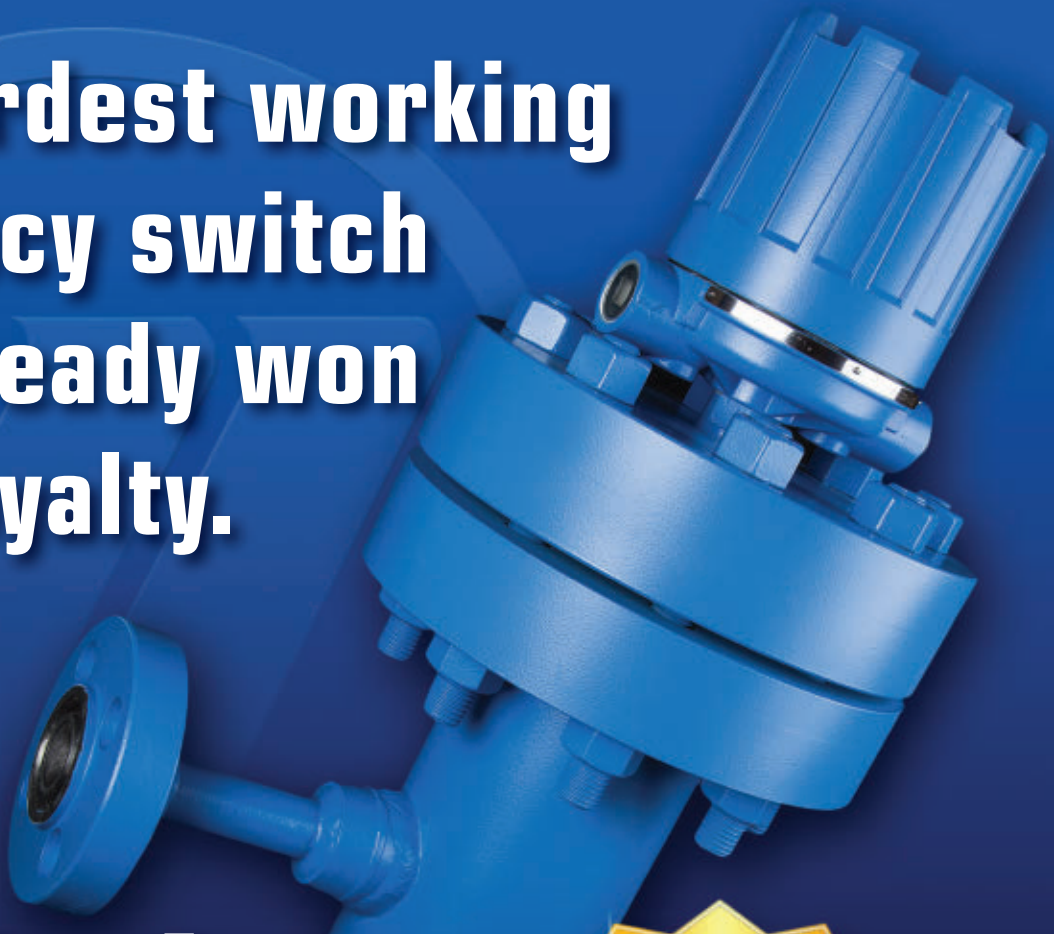

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Weight reduction achieved using a composite riser.			
Parameter	**Steel**	**Composite**	**% variation**
Weight of riser line	105 Te	-110 Te	-205%
Tension at top	449 Te	235 Te	-48%
Tension at mid riser	264 Te	166 Te	-37%
Base tension	150 Te	150 Te	0%

by composite pipe. All other components in the system were kept the same. Water depth selected was 2,000 m (6,562 ft) because the SLHR riser concept is well established and field-proven at this depth.

The internal diameter for the composite pipe and steel pipe was kept constant. Pipe wall thicknesses were selected for the respective material properties, but based on similar static loads. Global finite element models were created of the two riser systems and analyzed to compare the differences.

The main findings from the study are presented below.

Lower riser assembly. A flexible joint (or a rotolatch system) is typically used for hybrid risers to accommodate the large bending moment at the base of the riser and to ensure adequate extreme storm and fatigue performance. Due to the increased flexibility of composite pipe it may be possible in some circumstances to eliminate this flexible joint at the riser base. However, for the study case, removal of the flexible joint was not possible due to loading at this location.

Tension. A base tension overpull is required to limit riser fatigue damage and reduce loads on the rigid base spool. For the steel riser, the required top tension drives the selection of the wall thickness as the high tension causes high axial stress for the top half of the steel riser.

The required top tension for the composite riser is less than the base overpull. This is a result of the low riser weight which when combined with insulation coating makes the pipe buoyant, even when flooded. Selection of the wall thickness for the composite riser is therefore not impacted by tension requirements. To achieve a base tension of 176 metric tons (194 tons) at the riser base, the steel pipe SLHR requires the buoyancy tank to apply 365 metric tons (402 tons) of tension, whereas the composite riser SLHR requires just 155 metric tons (171 tons).

Buoyancy tank. The volume of the buoyancy tank is defined by the required upthrust, a function of the total weight of the riser components. Supporting the single riser leg weight forms a large proportion of the total required upthrust. For a composite pipe SLHR, the size of the buoyancy tank can be reduced by up to 40%. The cost of the buoyancy tank calculated for the steel riser is roughly £1 million for materials and fabrication. Potentially, a 40% saving can be achieved using a composite riser, due to the reduced size of the buoyancy tank. Handling and installation cost savings are also likely with lessened requirements for lifting capacity, storage space, and pressurization time.

Riser fatigue performance. The fatigue performance of the riser improved significantly due to the composites' fatigue characteristics and the eradication of welds along the riser leg. Although the fatigue value of composite pipes is not well established, it is expected to be better than the steel parent material – fatigue details of which have been used in order to illustrate the expected improvement in fatigue life.

Reduced buoyancy has a negative impact on the steel stub located below the buoyancy tank and results in a 33% reduction in fatigue life (although this has not been optimized). The fatigue hot spot for the steel riser was determined to be at the weld closest to the URA interface. Replacing the steel pipe with a composite material improves life at this location by a factor of more than 100 times. The hot spot for the composite riser is at the steel stub below the buoyancy tank – here fatigue life is 200% higher than the steel riser minimum fatigue life.

Cost. Composite materials are expensive and the required composite pipe could cost close to three times the price for an equivalent

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Shown is Mexican President Enrique Peña Nieto's signing the country's energy reform into law in December 2013. (Photo courtesy the office of Enrique Peña Nieto)

Assessing Mexico's New Offshore Oil & Gas Opportunities

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When Mexico's historic energy reform legislation became law on Dec. 21, 2013, it opened the country to foreign investment in its oil and gas sector for the first time in 75 years. A linchpin of President Enrique Peña Nieto's campaign, the far-reaching reform and subsequent secondary legislation enacted an entirely new legal framework for all of Mexico's oil and gas activities. Every sector is affected, from geological surveying, to storage and transportation, to exploration and production.

A competitive bidding process was also established. The newly formed Mexican National Hydrocarbons Commission (CNH) has published the bidding and contract terms for the first three phases of the Round 1 bidding process, which includes shallow-water, shallow-water production, and onshore areas. The Commission is also expected to announce the deepwater areas to be awarded, as well as bidding and contract terms. Join Mayer Brown lawyers Dallas Parker and Gabriel Salinas as they discuss the bidding process in Mexico.

What You Will Learn:

- First phases of Round One results and a look at what's ahead
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Guest Speakers:

Dallas Parker, partner in Mayer Brown's Corporate & Securities practice

Gabriel Salinas, senior associate in Mayer Brown's Houston office

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Comparison of the key design aspects of the steel and composite risers.

Parameter	Steel	Composite	Comments
Max hang-off load (Te)	94	93	In an SLHR the flexible jumper to the vessel acts as interface between the vessel and the vertical riser leg thus keeping the two isolated. Therefore negligible change in hang-off loads
Max hang-off bending moment (kNm)	261	282	
Max stress utilization	0.63	–	While stress is the driving criteria for steel, strain is the driving criteria for composites
MBR safety factor	–	2.76	MBR is larger than minimum acceptable
Max tension utilization	–	0.14	Tension is small in comparison to allowable
Buoyancy tank displacement (m)	247	211	Smaller drag area causes smaller buoyancy tank displacement
Buoyancy tank tension (Te)	451	258	43% less tension required
Max bending moment at base of URA (kNm)	116	62	Approximately 50% lower bending moment for upper and lower riser assemblies
Max bending moment at top of LRA (kNm)	581	270	

steel pipe. However, savings can be achieved through the reduction in buoyancy tank size and LRA/URA sizes. Probably the biggest cost saving would come from simplifying the installation process as the reeled pipe and the smaller buoyancy tank would require less offshore installation time and smaller installation vessels. Despite an improvement in performance, there is not an obvious argument to adopt composites based on cost alone. However, the composite pipe cost is at least comparable to a steel option in the SLHR configuration considered.

Deeper waters

In deepwater, the technology limits of using steel often present serious challenges to the viability of existing riser designs. Design issues include the weight of riser strings longer than 3,000 m (9,842 ft) and achieving adequate fatigue lives. Here the advantages of composites can potentially be harnessed to solve the issues.

Conclusion

Composite systems have been tested and can be applied in offshore risers, and could be considered for further riser applications, with potential improvements over steel alternatives.

Now codes and standards specifically applicable to composite risers are being developed currently by DNV GL and API, which should reinforce the growing acceptance of this new technology.

A hybrid riser system can benefit from changing the steel pipe sections with composite pipe sections. Bulk sizes of the buoyancy tank and the riser assembly frames will be reduced as a result of the enhanced weight-to-strength ratio of the pipe section. Installation will require reduced lift capacity and time duration.

Composites can help the offshore industry reach new depths and operate in harsher environments. They represent an exciting potential solution to future design challenges for the riser industry. However, more radical design solutions should be considered to further optimize riser design by taking advantage of the material properties of the composite pipe.

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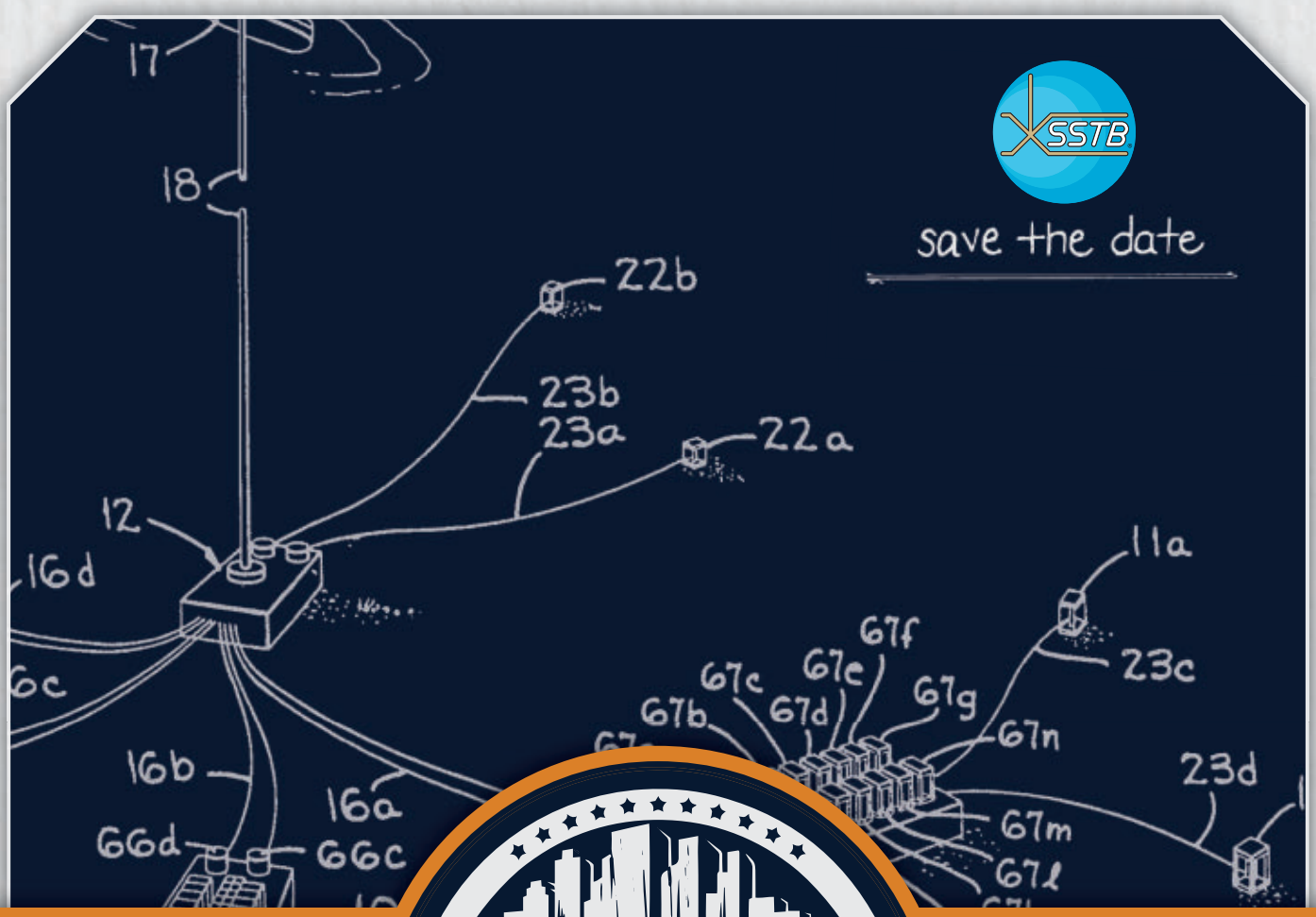

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OPENING PLENARY **SESSION** *ALL ATTENDEES ARE WELCOME TO ATTEND!*

TUESDAY, **NOVEMBER 3, 2015**

3:30 – 5:00 p.m. **SESSION 1:** OPERATIONAL SOLUTIONS - Hall A

Session Chairman: Jeremy Burford, Surface Engineering Manager; *BHP Billiton Petroleum (Americas, Inc)*
Co-chairs: John Glithero, President – Americas; *Wood Group PSN*
Rusty Desormeaux, Sr. Manager – GoM Operations; *Murphy Exploration & Production USA*

PRODUCTION OPTIMIZATION OF THE SHENZI FIELD IN THE DEEPWATER GULF OF MEXICO

Patrick Ashton, Production Engineer; *BHP Billiton*

METHANOL USAGE IN DEEP WATER PRODUCTION AND ITS IMPACT ON REFINERIES

Ron Claybon, Crude Quality Specialist; *Shell Pipeline Company LP*

USING THE TAMAR PRODUCTION MONITORING SYSTEM TO MANAGE ISRAELI GAS DEMAND AND MINIMIZE OPERATIONAL RISKS

Russell Hebert, Production Engineer; *Noble Energy*

WEDNESDAY, **NOVEMBER 4, 2015**

8:00 – 9:00 a.m. **KEYNOTE** PLENARY SESSION – Hall A

WELCOME & INTRODUCTION

Robin Dupre, Conference Director; *PennWell*

CHAIRMAN'S OPENING REMARKS

Dave Blackburn, Director, Equitorial Guinea Asset; *Hess Corporation*

KEYNOTE PRESENTATION

Rob Fast, Vice President, Offshore Americas and West Africa; *Hess Corporation*

9:45 – 11:15 a.m. **SESSION 2:** REGULATORY – Hall A

Chair: Mike Lynch, Senior Operations Advisor; *Granherne/KBR*
Co-chairs: Kris Kallaway, Director, Marine Assurance Integration; *ConocoPhillips*
Pete Stracke, Asset Manager - US Offshore; *Statoil*

COAST GUARD OFFSHORE ORGANIZATIONAL AND REGULATORY CHANGES

Joshua Reynolds, Captain; *United States Coast Guard*

SAFETY MANAGEMENT IN THE DEEPWATER OCS: THE JOURNEY - WHERE ARE WE AND PATH FORWARD

Charlie Williams, Executive Director; *Center for Offshore Safety (COS)*

OPERATIONAL FOCUSED ADVOCACY IN THE AGE OF INCREASED REGULATORY ACTIVITY

Evan Zimmerman, Executive Director; *Offshore Operators Committee*

SESSION 3: BROWNFIELD INTEGRITY MANAGEMENT – Hall A

12:45 – 2:15 p.m.

Chair: Tim Colwell, Asset Manager – Brazil; *Shell Brasil Petróleo Lt.*
Co-Chairs: Paul Danos, Executive Vice President; *Danos*
Gerhard Visser, Offshore Operations Manager; *Williams*

API'S HPHT STANDARDS

David Miller, Director, Standards; *API*

OFFSHORE EQUIPMENT INTEGRITY MANAGEMENT

David Breitkreuz, Equipment Integrity Team Leader; *Shell Exploration and Production Company*

UTILIZATION OF NON-TRADITIONAL ISOLATION TECHNOLOGY IN DEEPWATER

Nasbi Guzman, Senior Mechanical Engineer; *BP*

SESSION 4: START UPS/FIRST YEAR OPERATIONS – Hall A

3:00 – 4:30 p.m.

Session Chair: Craig Sherer, Operations Manager, Deepwater Projects; *Chevron North America*
Co-Chairs: Sergio Matos, Production Operations & Midstream Manager; *Petrobras America Inc.*
Donal Rajasingam, Asset Manager; *Shell Exploration & Production Company*

ÅSGARD SUBSEA COMPRESSION START-UP

Pål Hedne, Technical Manager; *Statoil*

JACK & ST. MALO START-UP LESSONS LEARNED

Jonathan Jones, JSM Start-Up Manager; *Chevron*

RESOURCE MANAGEMENT

Neil Hopkin, GoM Operations; *Hess*

KEYNOTE PLENARY SESSION

ALL ATTENDEES ARE WELCOME TO ATTEND!

THURSDAY, **NOVEMBER 5, 2015**

8:00 – 9:30 a.m. **SESSION 5:** OPERATIONAL SOLUTIONS– Hall A

Session Chair: Amro Hamza, GOM Operations Manager; *Anadarko Petroleum Corporation*
Co-Chairs: Charles Hutto, Asset Manager, Africa Business Unit; *Noble Energy*
Rick Francis, Business Development Manager; *FMC Technologies*

MODERN SUBSEA FIELD SUPPORT VESSELS ADVANCE RIGLESS INTERVENTION CAPABILITIES

Eddie Karlsen, Sr. Well Intervention Advisor; *FTO Services*

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Elizabeth Mann, Senior Process Engineer; *Shell*

15K RISERLESS STIMULATION AND FLOWBACK

Jay Odom, Senior GoM Production Engineer; *Anadarko Petroleum Corporation*

10:15 – 11:45 a.m. **SESSION 6:** FLOW ASSURANCE – Hall A

Session Chair: Wayland Christensen, UC- MCP Operation Manager; *Chevron Global Upstream & Gas*
Co-Chairs: Richard Loveland, Area Reservoir Development Manager, GoM; *BP*
Jay Hachen, Deepwater Subsea Facility Manager; *W&T Offshore*

RISER GAS LIFT - ATLANTIS AND NAKIKA FIELD

Prashant Haldipur, Petroleum Engineer; *BP*

PARAFFIN BLOCKAGE REMEDIATION IN FLEXIBLE FLOWLINE

Robert James, Associate Production Engineer; *Murphy Oil Corporation*

REMEDIATION OF A PIG/PARAFFIN OBSTRUCTION IN A DEEPWATER GOM FLOWLINE

Kartik Ramachandran, Production Engineer; *Petrobras*

11:45 a.m. **LUNCH** – Floral Ballroom

12:10 p.m.

Art founded Triple Double in August 2007 after he completed the sale of John S. Herold, Inc. to IHS. He serves as portfolio manager and oversees the firm's energy research. From 1984 to 2007, Art was Chairman and CEO of John S. Herold, Inc. and grew the company into a widely recognized independent authority in oil and gas research and consulting. From 1976 to 1984, he was an energy equity analyst with Argus Research Corp., The First Boston Corporation and Oppenheimer & Co., Inc. Art currently serves on the Board of Directors of PAA Natural Gas Storage, L.P. and Pioneer Southwest Energy Partners, L.P. Previously, he has served on the boards of Plains All American L.L.P., Pioneer Natural Resources, Cabot Oil & Gas Corporation, Evergreen Resources, Inc., Parker & Parsley Petroleum, the New York Society of Security Analysts, and was a past appointee to the National Petroleum Council. Mr. Smith received a BA from Duke University and a MBA from New York University's Stern School of Business. In addition, he holds the CFA designation.

1:00 -1:15 p.m. **PRESENTATION** OF SPEAKER **AWARDS**

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CHAIRMAN'S CLOSING REMARKS

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Tuesday, November 3, 2015 . . . . . 5:00 PM – 6:30 PM
Wednesday, November 4, 2015 . . . . . 9:00 AM – 6:00 PM
Thursday, November 5, 2015 . . . . . 9:00 AM – 12:00 PM

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People

Wärtsilä's board of directors has appointed **Jaakko Eskola** as president and CEO. He will assume the position on Nov. 1, 2015, succeeding **Björn Rosengren**, who will become the CEO of Sandvik.

John Smith, chairman of the Ceona board, has stepped down due to ill health.

Canada's Ministry of Natural Resources and Nova Scotia's Ministry of Energy have appointed **Roderick K. MacLeod** to chair the Canada-Nova Scotia Offshore Petroleum Board. He will serve part-time for six years.

AGR has appointed **Svein Sollund** as CEO and **Snorre Woll** as CFO.

Siem Offshore has appointed **Idar Hillersøy** as CEO.

Musa

Total E&P Nigeria Ltd. has appointed **Ahmadu-Kida Musa** as deputy managing director, deepwater district based in Lagos. He replaces **Charles Ngoka**, who has retired.

North Atlantic Drilling Ltd. has appointed **Scott McReaken** as CFO. He succeeds **Ragnvald Kavli**.

QinetiQ has appointed **Jamie Pollard** as CEO of its OptaSense distributed acoustic sensing business.

The Society of Exploration Geophysicists membership has selected **Bill Abriel** as president-elect for 2015-2016. He is scheduled to become president in October 2016. Also elected to the 2015-2016 board of directors were **Jie Zhang** as second vice president, **Mauricio Sacchi** as editor, **Rocky Detomo** and **Vladimir Grechka** as directors at large, and **Lee Lawyer**, who was elected by the SEG Council to serve as council chair. Completing the board of directors for 2015-2016 will be eight incumbents from the current board: **John Bradford**, the current president-elect, who will become president; **Eve Sprunt**, the current second vice president, who will become first vice president; **Christopher Liner**, the current president, who will become past president; **Alison Small**, who will serve a second year as treasurer; and **Guillaume Cambois**, **Gustavo Carstens**, **Xianhuai Zhu**, and **Maurice Nessim**, who will return as directors at large.

Anish Bhutani has joined Solomon Associates as E&P analyst based in the Calgary office. He will support various upstream operations benchmarking studies and custom consulting projects.

Bruno Faure has become president of the International Marine Contractors Association and chairman of the association's Overall Management Committee.

Ahmad Al Muhairbi has resigned from the independent committee of the board of Dragon Oil as a result of his appointment as a director to the board of Emirates National Oil Co.

Jee Ltd. has appointed **Jonathan McGregor** as head of engineering, **Grant Adam** as head of integrity management, **John French** as head of design, **Graham Wilson** as head of late life, **Paul Otway** as head of pigging, and **Joe Gransden** as head of project management.

Forfar

BMT Cordah, a subsidiary of BMT Group, has named **Andrew Glass** as managing director.

Bowman Gilfillan Africa Group has appointed **David Forfar** as head of the oil and gas sector group.

Odd Arne Slettebø has resigned as CFO of Noreco.

VAALCO Energy has appointed **Steven Pully** to the board of directors.

Keilloh

The Institute of Marine Engineering, Science & Technology has hired **David Kelly** as director of Asia/Pacific.

Seatronics Ltd. has appointed **Joanne Keilloh** as group QHSE coordinator based in Aberdeen. She will lead the QHSE function within the Seatronics Group and Acteon sister company, J2 Subsea.

Mitchell

Borets has named **Phyllis Mitchell** as vice president of human resources and **Kent C. Crago** as vice president of finance, both to be based in Houston.

Veripos has appointed **John MacLeod** as general manager of its Europe, Africa, and Middle East region.

Crago

TAM International has appointed **Ray Frisby** as vice president of its Western Hemisphere operations, including the US, Canada, Mexico, and Latin America.

UTEC Survey has promoted **Cory Goodyear** to general manager in Houston and **Simon Goldsworthy** to sales and marketing manager in Aberdeen, UK.

Altaaqa Global has hired **Julian Ford** as chief commercial officer.

GulfMark Offshore Inc. has appointed **Van DeWitt** to senior vice president of sales and business development.

Daniel Grant and **Filip Nevezi** have joined Litre Meter as a production engineer and an electronics engineer, respectively.

Merle "Duke" Miller has retired from Aqueos Corp. as sales representative.

Company News

Gulf Marine Service has awarded **Speed-Cast International** a multi-year contract for its new dual-beam Ku-band satellite service. This will provide broadband connectivity for client office applications and voice services across GMS' nine self-propelled, self-elevating accommodation jackup barges.

Mayer Brown has opened an office in Mexico City.

Makai Ocean Engineering Inc. is now providing expanded corrosion services at its Marine Corrosion Laboratory (MCL) in Kailua-Kona, Hawaii. The MCL is at the Natural Energy Laboratory of Hawaii Authority, making it the only location in the US with large flows of shallow and deep (to 3,000 ft/914 m) seawater continuously available. Lab capabilities include both basic corrosion science research and applied engineering solutions for the prevention of marine corrosion.

Tyco and **FSG** have organized a partnership to serve Brazil with safety and asset integrity solutions.

Oceaneering International Services Ltd. has acquired a minority equity interest in **Viper Subsea Technology**.

Hannon Westwood has completed the acquisition of **Novas Consulting**. Hannon Westwood said the acquisition is a first step toward making the company an energy information and analytics operation that includes full-service consulting.

LOC has opened an office in Paris, its first operation based in France.

Advanced Insulation has expanded its Houston-based operation with an additional 10,000-sq ft (929-sq m) manufacturing facility. The expansion means the company can now insulate subsea components and systems using its ContraTherm range at its own warehousing and manufacturing facility.

TAM International has restructured its regional businesses into two individual hemisphere-based groups. The Western and Eastern Hemisphere operations will now function as two separate teams.

Applied Material Solutions has purchased **Performance Process Inc.** in Mundelein, Illinois, and **Nottingham Co.**, PPI's chemicals division in Atlanta, Georgia.

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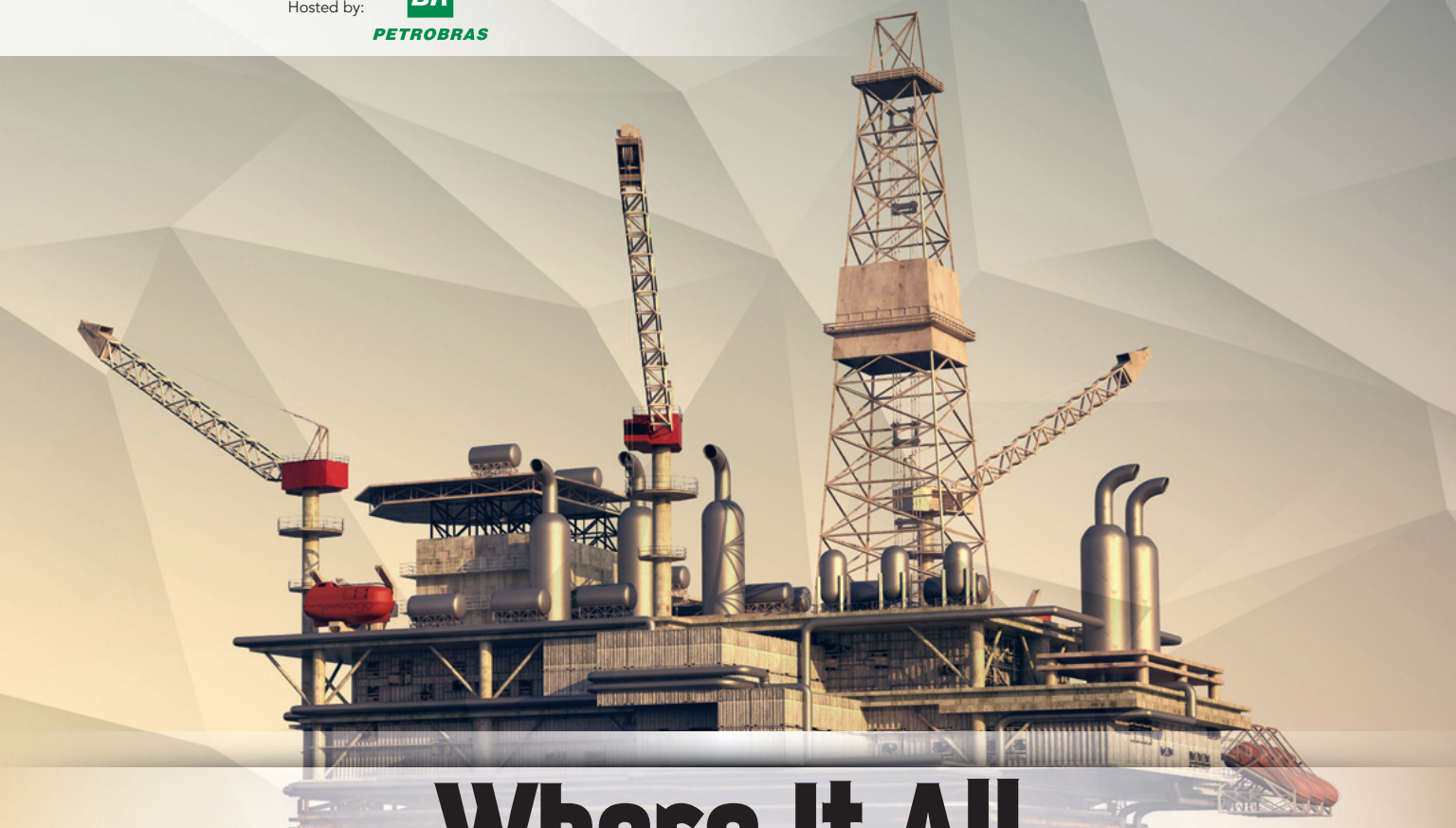

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Leadership and experience cannot be automated

In a recent *Time* article on efforts to humanize robotics, the author leads with the declaration, "Let me correct an impression you may have: robots are pretty much idiots."

While certainly an oversimplified generalization, the author's assertion nevertheless carries an underlying truth that we would do well to heed as our industry advances efforts to automate key elements of the drilling process: The need for a human to lead, built on core competencies, must never become de-valued in an automated environment.

As a former military combat pilot and flight instructor, this author has profound appreciation for the incalculable contribution to safety that automated control systems have brought to a high-risk industry.

The offshore drilling sector, likewise, has made enormous and sorely needed advances in automating pipe handling, tripping, connections, and other repetitive processes. These advances not only remove personnel from the "firing line" where injuries, or worse, are most likely to occur, but also help eliminate efficiency-robbing invisible lost time. Despite the tremendous HSE and efficiency benefits these and other advanced automation technologies bring to the table, we must not lose sight of the fact that no machine is perfect. As with human error, we frequently encounter system error, and the two often go hand-in-hand.

Likewise, it is important to keep in mind that humans write the control algorithms, humans build the architecture, and it falls on humans to be absolutely familiar with the capabilities, and more importantly, the limitations of the automated systems they engineer and oversee. The dilemma, of course, is to overcome the natural human tendency to become over-confident in the efficacy of the systems with an organization that has awareness, recognition, and reaction to unplanned events.

Returning to the aviation analogy, airline safety experts, as well as the US National Transportation Safety Board (NTSB) and other federal agencies, attributed over-reliance on automated systems as a major contributor in at least two deadly accidents in 2013.

According to the Associated Press, investigators specifically cited incorrect response to in-flight warnings caused by pre-flight programming errors, and failure to recognize, and react appropriately, to the frequent computer mode changes that occur during the course of a flight. A Federal Aviation Administration (FAA) study ranks so-called "pilot mode awareness" – or more correctly lack thereof – as one of the most common causes of the automation-related causal factors in accident and incident reports. Michael Barr, a former Air Force pilot turned safety investigator and instructor, perhaps best summarized how automation can lead to risky over-dependence, telling the AP that "once you see you're not needed, you tune out."

Consequently, it can be argued that the steady drive to automation strengthens, rather than diminishes, the need to foster and nurture an organizational culture that puts a premium on leadership skills, overall competency and, above all, human interaction. In other words, ever-advancing automation makes it imperative to instill a company-wide behavior at the task level that emphasizes total "crew awareness," rather than one that relies simply on setting an automated control mode, sitting back, and depending on the system to do its thing with no hiccups. It goes without saying that conditions during drilling, as with flying, are ever-changing. In these circumstances, unexpected events can happen that automation alone is unable to overcome. Just as the human pilot must be poised to react intuitively when a glitch in the aircraft's fly-by-wire system causes the plane to pitch nose down, no automated process can replace the core competencies that allow the human driller to respond instantly and instinctively when taking a kick.

Thus, the high-reliability and steadily automated world in which we operate accentuates more than ever the need for a competency-centric organization that promotes leadership and strong team behaviors – again at the task level – over unyielding allegiance to a plan. After all, a prerequisite of continuous improvement is for every member of an organization to learn from experience and past mistakes, which fall strictly within the human domain. Ours is an industry where multi-disciplined groups must constantly manage safety, efficiency and economic risks, making it essential that we cultivate a team behavior where no one operates wholly on autopilot.

The bottom line is that regardless of the level of sophistication, automated systems must be regarded as valuable aides to safe and efficient operations, and not an unattended cure-all. The awareness and instinct that comes with human leadership and team behavior must remain prominent in the automated environment. At the end of the day, competency will always provide the ideal antidote to complacency.

Yarko "JJ" Sos
Board Member
Check-6

This page reflects viewpoints on the political, economic, cultural, technological, and environmental issues that shape the future of the petroleum industry. Offshore Magazine invites you to share your thoughts. Email your Beyond the Horizon manuscript to David Paganie at davidp@pennwell.com.

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Blake DeBerry, Dril-Quip President and CEO, and Jim Kaculi, Dril-Quip Vice President of Engineering

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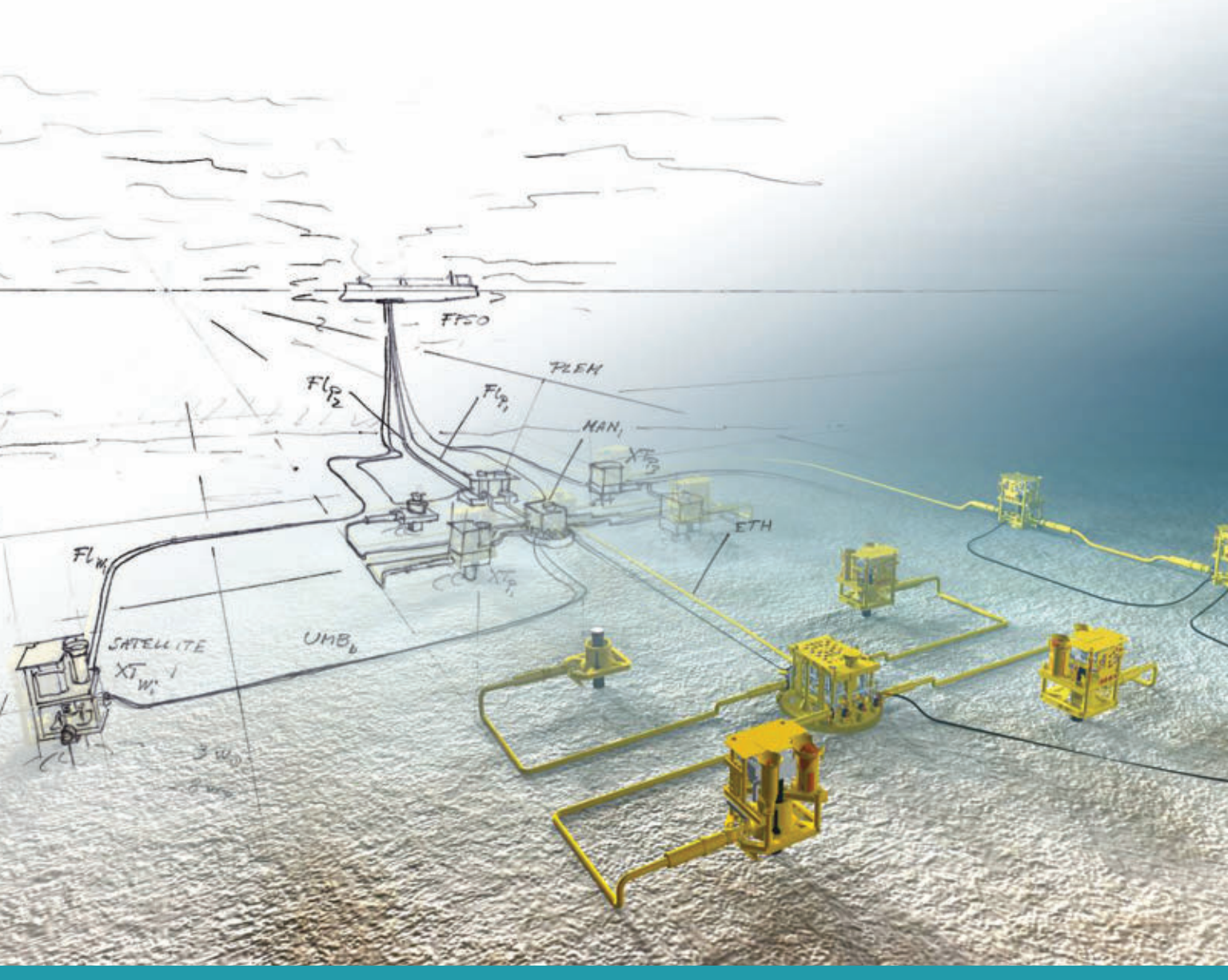

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BIG THINGS A SMALL COUNTRY CAN DO

The Netherlands is not just the home of Royal Dutch Shell, who back in April announced the second-largest acquisition in industry history with its proposed purchase of BG Group for USD 70 billion. It also boasts an impressive array of globally active service providers and is positioned at the heart of Europe's downstream market, combining the continent's biggest port, most concentrated gas infrastructure, and largest storage and refining capacity.

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Project Directors: Marie Kummerlowe
Editorial Coordinators: Angelo Basurto & Jun Wakabayashi
Collaborator: Gabriela Cordova, Karim Meggaro and Fraser Wallace
Report Publishers: Mariuca Georgescu & Ines Nandin
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In 1959, the Netherlands became a considerable gas player with the discovery of Groningen field, which remains one of the world's ten largest gas fields, and the country stands today as Europe's second-largest producer and exporter of natural gas with 3.0 trillion cubic feet (Tcf) of production in 2013, according to the EIA. Over 50 years of experience at Groningen has also fostered the development of a sharp skill set for the wider oil and gas industries. "A quarter of the state's income is directly attributable to gas, or gas related activities," explains Mart van Bracht, managing director Energy Division TNO, the Netherlands' organization for applied scientific research. "Many of our other key industries, from logistics to petrochemicals, are also derived from our relationship with gas." Adding oil to the equation, EY argues that the Dutch oil and gas industry is worth almost USD 17 billion a year and contributes 16,000 jobs to the Dutch economy.

Dick Benschop, president director, Shell Netherlands

Mart van Bracht, managing director, TNO Energy

With a population of less than 17 million and a landmass of only 41,526km^2, how have the Dutch managed to carve out their substantial oil and gas importance and expertise? Apart from Royal Dutch Shell, very few Dutch energy companies are household names. Even if some of the most innovative companies globally are Dutch, braggarts are frowned upon in this culture that maintains elements of the Calvinist tradition. Rather, companies prefer to invest in people and innovation as a winning combination and offer results rather than catchphrases, in line with their ultra-direct culture. The oil and gas industry's strength comes from this Dutch spirit and a backbone of independent and often family-owned companies, as well as the cooperation fostered between these actors.

The Dutch "polder model," or tradition of cooperation despite differences, is a helpful explanatory tool. A polder is a tract of low land reclaimed from the sea and protected by dikes. "The Dutch had to collaborate or else they would drown," explains Eric Wesselman, a partner at KPMG Netherlands. "That's why it's in the Dutch culture to cooperate: from the center of the country, water is pushed from farm to farm until it reaches the sea. If we didn't collaborate in this way, the country would be submerged. The Dutch are willing to challenge, but also to share knowledge and resources, and that makes us unique. It also affects how we look at the world: we see ourselves as part of the world we live in rather than separate from it; we are successful because we can easily connect with other individuals, companies, and countries." This understanding of the value of sharing information and partnering to bring complementary strengths has trickled down to the oil and gas sector. Geography has further strengthened this common-sense, consensus-based model. VandeGrijp's managing director Paul Nederlof, argues that "the close physical proximity that Dutch companies find one another in is an important contributing factor to generating this connectivity."

Paul Nederlof, managing director, VandeGrijp

Sander Vergroesen, managing director, IRO

Like their merchant ancestors, today's players do not shy away from new markets around the world. As Sander Vergroesen of the IRO, the association of Dutch suppliers in the oil and gas industries, explains, "we are a very small country, but we have been sailing the oceans for hundreds of years. We are sailors , and we are merchants; and when oil and gas appeared on the scene, it was the next step. Over the years we've developed as an industry, and since we are used to coming up with solutions all over the world, we are constantly trying to improve every day. This is what we are good at because since the beginning we have been used to developing together."

THE FAMILY CONNECTION

A key factor in the oversized destiny of this small nation has been the vitality of family-owned companies. According to PwC, 69 percent of all Dutch companies, excluding sole proprietorships, were family businesses in 2014, with these family-owned dynamics pervading the oil and gas sector as well.

"The culture of being a family owned company means we can keep our course straight," asserts Jan-Pieter Klaver, CEO of Heerema Marine Contractors. "People are proud to be a part of this company that works on projects that make people say 'Heerema can do things other companies can't.'"

Klaver even associates his company's role as a North Sea trendsetter to this family-company DNA. "We have seen since the late 1970s, with the introduction of our vessels Balder and Thialf into the North Sea, that the market has also followed along with us to a certain extent, and this is still true today. There are only specific companies that have the ability to do this: companies like Heerema that are family owned, take a long-term perspective rather than short-term, and are not listed."

Another Dutch family success story is that of A.Hak, a provider of pipeline, inspection, storage tank, and industrial services. Member of the board and former CEO W.D. van Geenhuizen pinpoints the importance of this family-owned background: "A.Hak has always been a family owned company. This allows us to let the company benefit from every cent of profit we make. As a father, I'm very proud to say that my son and daughter have stepped up to the responsibility of managing the company, with my wife and myself as

their chief advisors. After 51 years, in which we expanded from a modest local firm to a global player to be reckoned with, A.Hak looks forward to a challenging future, as a family business." The family element alone does not account for A.Hak's success, however. "Our entrepreneurship and continuous innovations are the driving forces behind our growth. We always keep an open mind to acquisitions that can further complement our already impressive range of interconnected services," concludes van Geenhuizen.

W. D. van Geenhuizen, member of the board and former CEO, A.Hak

Even Dutch listed companies draw upon this family-owned mentality. Arjan de Vries, COO Energy at Brunel, the globally active Dutch human resources specialist, believes that "although we are a listed company, which helps us to be compliant, transparent, and financially powerful, 60 percent of the company's shares are in the hands of the primary shareholder. I like to think that this makes us a stock-listed, family-owned company: the best of both worlds. We can be really entrepreneurial here: we have our responsibility to the stock market, but we can also develop long-term strategies that we believe in."

Arjan de Vries, COO Energy, Brunel

GOD MADE MAN, THE DUTCH MADE HOLLAND

The Dutch farming heritage, strong family-enterprise tradition, and no-nonsense attitude have shaped industry players and dynamics, but perhaps more important is the Dutch refusal to accept a set of conditions given at the outset. After all, almost half the country was reclaimed from the sea.

"In Dutch, 'research' translates to 'search again' or 'onderzoek,' which for me has a more expansive view of what research actually means," explains Frits Doddema, managing director of Seal for Life, a Dutch expert in corrosion prevention and control. "As managing director, I aim to gain a better understanding of the industry needs by collaborating with local and international players and universities to learn and innovate beyond the basic requirements."

Reliability is one of the top concerns of the Dutch: innovation is not about fancy words but about concrete, long-term solutions. Seal for Life illustrates this mindset with their advanced communicative coatings. "We can guarantee our coatings for the life of a pipeline. In other words, what we put on does the job and does it safely; we have never had a product installed that was faulty or failed to effectively meet the demands of our clients. To give one example of our effectiveness, our coating has been used by Saudi Aramco in Saudi Arabia since 2002. For all the pipelines we have

rehabilitated, there have thus far been no case of failure," asserts Doddema.

World-leading pipe supplier Maats has also decided to build its expertise via long-term, in-house innovation. "Five years ago, we were building only 20 percent of the products we supplied to clients, whereas today we supply approximately 80 percent in-house products," explains CEO Gerbin Wansink. "Taking note of what our clients were demanding, Maats decided to offer real solutions by tweaking the existing machinery and developing our own brand of pipeline equipment. Since quality is a major concern for ourselves and our clients, we decided to create new innovative machines and further expand our collaborations with other companies."

Frits Doddema, managing director, Seal for Life

Gerben Wansink, CEO, Maats

Furthermore, "we are constantly trying to innovate in developing and engineering new equipment and improving existing equipment by adding the latest technology to our machinery, such as load indicators, sensors, and even enclosed cabins with air conditioning. These extra-added features give assurance to our customers around the globe where regulations exist and give their employees comfort they might not find elsewhere," adds Wansink.

Paul van Riel, CEO, Fugro

In offshore as well, the Dutch are pushing the envelope. Global geotechnical provider Fugro is betting on innovation even in tough financial times. "What we've decided here at Fugro is that we will not cut out our R&D unit, and we will continue to protect all our efforts in innovation. We are very careful to maintain our expertise, and when the market goes back up we will use this core of knowledge," claims the company's global CEO Paul van Riel.

Since divesting of its geoscience division to CGG in 2012, Fugro has refocused on its core expertise in geotechnical and survey services. Current innovation projects include a standardized geotechnical laboratory data analysis package and subsea laser vision technology for automated fast pipeline and subsea structure inspection, as well as upgrading the world's most accurate GPS positioning system for offshore use.

The Netherlands has a leading innovation culture in such disciplines as heavy lift, short sea shipping, and long-distance towing, a field in which Alp Maritime Services is geared to set a new industry standard with its Alp FUTURE Class. Alp Maritime Services is the

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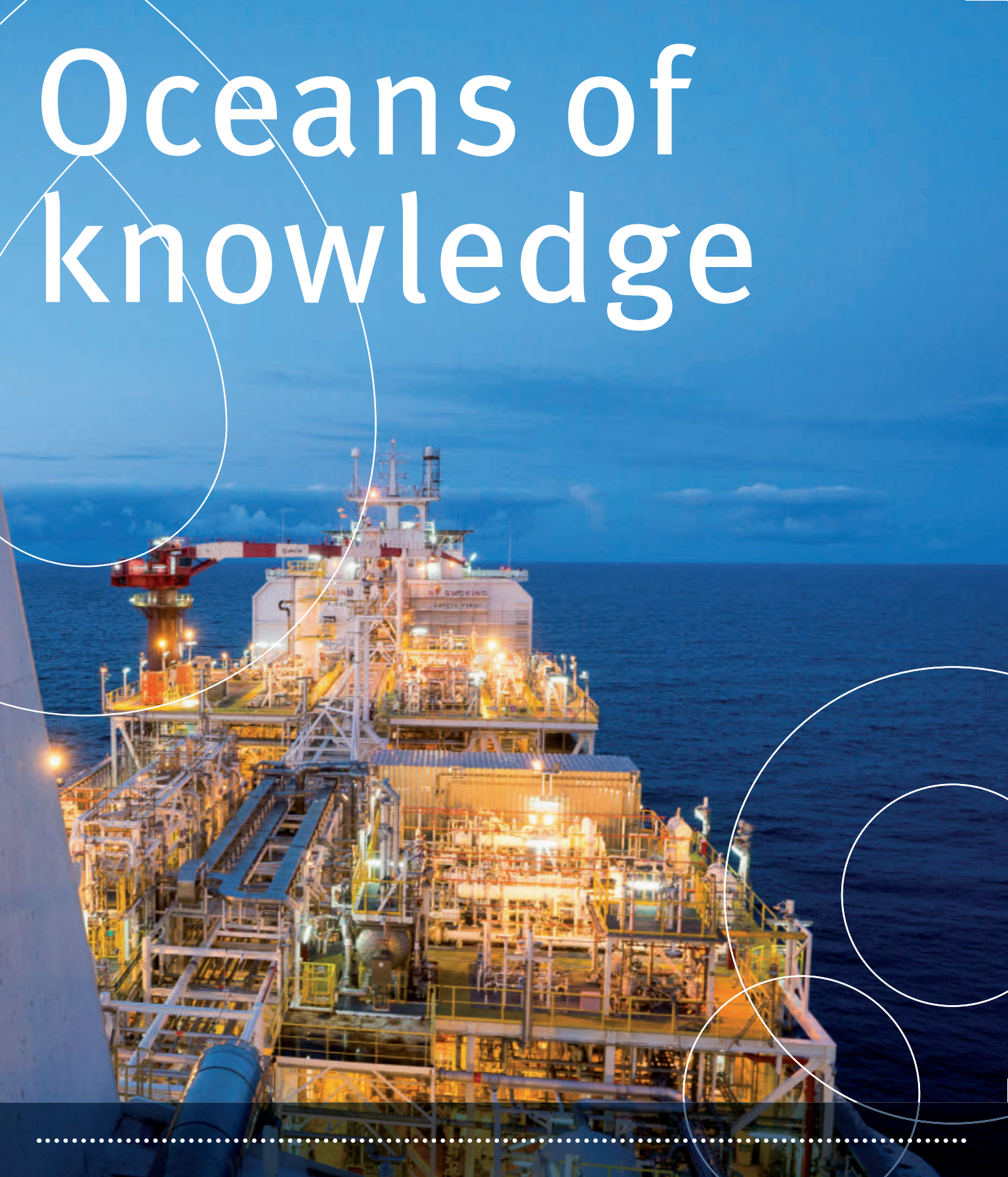

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CALLIDUS GROUP: TRANSLATING THE DUTCH PASSION FOR INNOVATION INTO AN ART

Since its creation in 2006, Callidus Group has focused on the concept design, engineering, and production of high standard, customized solutions for industrial and offshore applications. The company lacks none of the Dutch can-do attitude, with the ambition to solve the unsolvable. "We believe that by creating innovations we can change the world, and we thus aim to develop products and processes that change our industry. Generally, when companies have an idea it remains an idea and does not come into fruition. Callidus Group invests in making dreams come true for our customers by keeping them central and working hand-in-hand with them throughout the entirety of each project," explains managing director Wilco Stroet. The company sets itself apart even more by investing the lion's share of its earnings back into R&D and promoting a Dutch brand of structured innovation. "Callidus Group is an extremely well structured organization, and we approach problems with extreme discipline. This approach translates into higher creativity and the replicability of our results."

Wilco Stroet, managing director, Callidus Group

The company also encourages out-of-the box thinking by searching for the best talent beyond the traditional oil and gas pool. "It is my belief that many issues in the oil and gas industry have already been solved in other sectors, but we are not aware of these solutions due to tunnel vision within this conservative industry that hinders many innovations. I work to ensure that Callidus Group values diversity and hires people from other industries, such as art and mechanics to enable a broader perspective on how we approach problems," declares Stroet enthusiastically before summing up, "our company is focused on achieving results in a creative manner and that is the real magic that sets us apart!"

"only towing company that has invested heavily in towing vessels with multifunctional anchor handling capacities and DP II capability," details CEO Paul Mulder.

Paul Mulder, CEO, Alp Maritime Services

The "FUTURE Class boasts not only 3,500 tons fuel capacity, which is roughly 1.5 times that of current vessels on the market, they also have 300 ton bollard pull compared to the 200 tons of our competitors," adds Mulder. Alp Maritime Services' vessels will serve to increase efficiencies in long-distance towage due to their fuel efficiency and decreased transit time, major advantages at a time when both costs and the green agenda becomes ever more pervasive concerns.

INNOVATING AT A LOWER OIL PRICE

The Dutch focus on reliability and efficiency is especially salient following a year of lower oil prices. Local players realize now is a prime time to push for efficiencies neglected in years past, when a record high oil price made speeding through projects the priority.

"Now is a great time to review what happened during that last period and improve efficiencies, based on the idea of saving costs for clients," according to Brunel's de Vries. "This is a great opportunity for us: we get to talk to our clients, build better relationships with them and partner with them to help them realize those savings."

An oft-cited example of Dutch innovation bringing these efficiency is Ampelmann, a provider of offshore access solutions that

make arriving at offshore structures "as easy as crossing the street." CEO Jim Craig asserts that before our walk to work systems not only promote safe business practices, they also increase the speed with which employees can access offshore structures and cut costs on such transport-related expenses as helicopter shuttling trips."


Jim Craig, CEO, Ampelmann

Recognizing the benefits of Ampelmann's technology in terms of efficiencies and customer satisfaction, Chevalier Floatels has converted two of its accommodation units, the DP Gezina and DP Galyna, with the Amplemann system. "We were very innovative in this sphere being the first to own a dedicated DP2 W2W accommodation vessel with an Amplemann system, whereas most other market participants only use an Ampelmann system for certain jobs. Chevalier Floatels want to expand in this segment and is looking into bigger bed capacity for larger projects," details CEO Marcel Roelofs.


Marcel Roelofs, CEO, Chevalier Floatels

However, one of the most active companies helping the Dutch to put in place these efficiencies is not home-grown but rather Scandinavian software provider IFS. "Companies have not only begun streamlining processes from an operational standpoint, but also from an IT point of view. That's where IFS has experienced the most market opportunities," claims Marco Verdonschot, managing director of IFS Benelux. "We've been able to provide our expertise in areas of enterprise resource planning (ERP), enterprise asset management (EAM), and enterprise service management (ESS)—ultimately creating custom-tailored solutions that help clients operate more competitively from an efficiency perspective."


Marco Verdonschot, managing director, IFS Benelux


Bram Roelse, CEO, Royal IHC

The Dutch flagships have taken notice, and vessel maker Royal IHC has chosen IFS as its software partner. "In line with the "One IHC" vision, IFS is helping to increase business agility, transparency, and uniformity by consolidating 17 different ERP platforms into one—IFS Applications," continues Verdonschot.

Royal IHC's CEO Bram Roelse, concurs and adds, "it is not possible to compete solely by working harder – we have to offer supremely integrated, innovative products. This means we invest in developing tomorrow's designs."

KEEPING UP WITH E&P

Just as its North Sea neighbors, the Netherlands faces a serious challenge in terms of declining production. An additional USD 1.525 billion is needed to maintain current production levels according to the EBN, the Dutch state-owned body that assists operators. The authorities are keen to turn the tide and ensure 30 bcm per year in production by 2030, especially as much valuable infrastructure will be decommissioned if a sufficient level of E&P activity is not maintained.

Back in 1974, the government already introduced a small field policy to preserve the Groningen asset and encourage production in smaller fields with a guaranteed buyer. Since 1974, smaller fields have actually produced more gas than the larger Groningen field. By 2010, though, production was declining, leading to the introduction of a marginal fields tax that has been well received by industry and experts alike. According to Woods Mackenzie, between 2011 and 2028 projects benefiting from this tax will add 17 bcm of reserves or 10 percent, a value of USD 785 million to companies and USD 925 million to the government. "This incentive has worked well," concurs Jo Peters of the Netherlands Oil & Gas Exploration & Production Association (Nogepa). "Now Nogepa hopes to encourage the government to reinforce this allowance which would certainly deliver more developments. The horizon for encouraging investment needs to stretch for the next five to ten years and have an international perspective."

However, declining reserves and the current low oil price are not

INNOVATION IN OFFSHORE LOGISTICS

Peterson started in the 1920s as a family owned company in the grain inspection business and had evolved this quality assurance expertise into the offshore logistics market for oil and gas by the 1970s. By the 1980s, the company had introduced a unique and collaborative offshore logistics model, the South North Sea (SNS) pool.

"We eventually saw a huge opportunity for companies to start sharing resources more comprehensively when, in the late 1980s, they started to talk more to each other as a group of operators. We presented a plan for the operators to pool their logistics resources, including the chartering of vessels and supply bases. Although at this point, operators were beginning to share vessels, we saw an opportunity to step in as an independent charterer, acting as a central point for planning supply runs and also dealing with the details

Erwin Kooij, CEO Offshore Group, Peterson

of how to invoice each company for the capacity it was using on these vessels. The combined pool made a lot of sense for operators, and eventually became known as the SNS pool," details Erwin Kooij, offshore CEO of Peterson.

Over the years, we streamlined the concept to open one "new base in Den Helder in 2004, which reduced overall sailing time and allowed us to create a state-of-the-art facility. Over the last decade, most of the industry has moved its operations to our base in Den Helder which is a further testament to the success of the SNS Pool and our initiative in making it happen. The supply base today is still one of the most modern on the globe, and also one of the most compact," explains Kooij.

the only challenges the industry must face: public opinion of gas has taken a major hit since small earthquakes began to occur around the Groningen field in the late 1980s, with more frequency in the past five years. This summer, the government mandated a cap on production at 30 bcm, a 24 percent year on year reduction. This sharp decrease will have a major impact on overall production, as Groningen field currently represents 75 percent of Dutch production, according to the EIA.

Nonetheless, industry players remain cautiously optimistic. In 2014, of the 93 E&A wells spudded in Europe, the largest number (28) were in the Netherlands, according to Wood Mackenzie, which also estimates that E&P activity will increase locally in the next five years. "The general consensus seems to be that Dutch upstream is still interesting because of the relatively low capital requirements and low political risk," argues Eric Wesselman of KPMG. Gilbert van den Brink, managing director of Wintershall, concurs. "The E&P environment in the Netherlands is good, predictable, and stable. The authorities are reliable partners to work with, despite the maturity."

Jo Peters, secretary general, NOGEPA

Eric Wesselman, partner, KPMG

As a mature market, "many of the larger players have moved out, to be replaced by smaller operators," adds Wesselman. "There are more operators here today than in previous years, including some that have entered upstream operations for strategic reasons, including GDF Suez and Taqa... Nonetheless, one important thing to consider is that the overall level of activity in the market today is not increasing, despite the number of new companies arriving," cautions Jeff Sluijter, partner at EY.

Jeff Sluijter, partner and energy leader, EY

Furthermore, "the current government's focus on renewable energies means that they are not properly incentivizing the production of gas in the Netherlands… If investment were put into increasing gas power generation, it might in turn make the upstream more attractive," adds Sluijter.

Operators are thus looking to new plays and novel techniques to

increase production. Van Bracht of the TNO argues that "most of the increase in production must come out of existing fields. Enhanced oil recovery is essential, and, along with EBN, TNO is investigating intensively possible means by which to improve recovery rates. The operators have are extremely interested in field life extension and for re-opening stranded fields, and so our work is extremely important to these enterprises."

Gilbert van den Brink, managing director, Wintershall

German operator Wintershall has not shied away from novel plays in gas, especially for tight gas at the K-18 Golf field. "Developing tight gas offshore is not the most obvious thing to do of course, but we carefully looked at our options, working closely with expert consultants to complement our in-house knowledge from well stimulation to hardware subsea well design. To be totally honest, the development of the field, which is taken as a phased approach, has thus far exceeded our expectations," van den Brink asserts.

The company is already broadening its portfolio into oil with the discovery of an oil accumulation in block F17 in 2013. "It's an enviable position to be in, to be in this mature base with an incredible amount of expertise, while still being able to produce a healthy profit margin," van den Brink concludes. "The recent oil finds will take us into the future. Hence, I still see a bright North Sea future ahead of us."

Nick Dancer, general manager, Petrogas E&P Netherlands

The newest entrant to the Dutch market, Petrogas E&P, who purchased Chevron's North Sea blocks in 2014, is also betting on new plays in gas. "We are now the leading producer of shallow gas in Northwest Europe. It's still a relatively new play, so we see significant running room here in the Netherlands and potentially other areas in the North Sea," explains Nick Dancer, managing director of Petrogas E&P Netherlands.

MOVING INTO OFFSHORE

The Netherlands' continental shelf may be less active than that of its Norwegian neighbor, but offshore expertise developed locally serves the global industry. Although this market segment has been hit by a lower oil price, many Dutch companies are making lemon into lemonade and seizing the moment to increase their offshore footprint for the inevitable market upturn.

Volker Staal and Foundations (VSF), a civil contractor specializing in heavy and complex foundation work, traditionally focused on the onshore industry and stands today as a clear example of the move many have undertaken towards a dual onshore and offshore focus. Managing director Pieter Arie Kraaijeveld has steered the company's course into the offshore, which he cites as "an extremely dynamic and interesting market due to the different types of contracts and different ways of cooperating with clients."

Pieter Arie Kraaijeveld, managing director, VSF

Claude Pelzer, managing director, De Regt Marine Cables

Paul Dits, director, Kreber

"As opposed to ten years ago, we're getting more and more into offshore. Although we're relatively small in scale as a company, we've started to invest in more fixed assets. For instance, we just recently rented a spot in Vlissingen to build the test jacket for the Pioneering Spirit. From our perspective, there are limitless possibilities to cooperate with other service providers in the offshore industry—further strengthening our interest," he explains.

Onshore pipeline specialist Selmers has built a solid reputation for its extensive in-house R&D initiatives and expansive portfolio of pipe blasting systems, handling equipment, and coating solutions. Since his arrival as CEO in 2012, Roderik van Seumeren, has decided "to diversify the portfolio and shift towards offshore work, striving to structure a substantial percentage of our business to this particular sector by 2017."

Meanwhile, De Regt Marine Cables joined CGG's equipment-focused subsidiary Sercel in 2012, strong on over 90 years of experience in cable design. Now a leading designer and manufacturer of custom-engineered, dynamic cable solutions for subsea applications, De Regt has also decided to shift towards offshore, but from a seismic rather than onshore positioning. Managing director Claude Pelzer aims "to grow the company within the oil and gas and energy markets given the plethora of opportunities for innovative, value-adding companies like De Regt Marine Cables. In oil and gas and energy, our cables offer ideal solutions for remotely operated vehicles (ROVs), blowout preventers (BOPs), and large trenchers, among other applications."

"De Regt Marine Cables is focused on building long term relationships and furthering its reputation as reliable company committed to delivering the products clients actually need, especially at a time when quality and efficiency are at the top of energy companies' agendas," Pelzer adds.

Designer and manufacturer of specialized machinery Kreber has a long-standing presence in offshore, but new management is actively strengthening its market penetration. Director Paul Dits decided that "given the strengths of Kreber from its large manufacturing plant to its strategic location, and in-house engineering team, there was more potential for us in the offshore market."

Kreber's unique customer-centric offering is based upon collaborating with clients for tailored seawork machinery. "Without giving away our NDAs, we continually receive inquiries from clients on how they can improve their activities and efficiencies offshore thanks to a Kreber machine that has such or such capabilities. Most of the products we develop are the result of a specific client request for which we undertake a feasibility study, develop, and market the product. We focus 100 percent of our efforts on such tailor-made solutions. In essence, every machine we build is an innovation because it is a tailor-made

product and is used by clients to solve a problem that has not been solved before," affirms Dits.


Richard Cornelissen, CEO, PFF Group

In terms of pushing the limits beyond simple offshore activities, subsea is another horizon for the Dutch. Home grown N-Sea Group hopes to become a leading subsea IRM company after acquiring Stork's subsea division in 2014, while equipment provider, PFF Group, one of the four companies around the globe that has an enterprise framework agreement with Shell, is now looking more into subsea. "In preparation for huge growth in the subsea business, our parent company has recently set up a subsea division within the Galperti Group. To effectively capitalize on forecasted demand, we're working on modifying or enhancing our sales activities in the region to appeal to the type of clients found in subsea," claims CEO Richard Cornelissen.

Cornelissen also looks to international expansion to complement PFF's growing portfolio. "We started our first non-Dutch venture in Germany about six years ago. Now, another six years down the road, we've ended up with 15 different branches, further fuelling our worldwide diversification initiatives across market segments and product lines," he concludes.


GEOJE, SOUTH KOREA, NOV 30: Prelude FLNG in the shipyard of Samsung Heavy Industry in November 30, 2013. Photographer: Penta Press and Polaris Prelude FLNG Hull Float Launch,courtesy of Shell

GLOBAL EXPLORERS

"We are a small country, but the Dutch are everywhere. If you are on some spot in the world, there will most likely be a Dutch man there," claims Kraaijeveld of VSF. "The way the Dutch people see business opportunities brings them all around the world. The country boasts a plethora of those types of individuals with an inner hun-

ger for self-improvement and professional development in the context of an increasingly globalized economy." Indeed, the Netherlands boasts the world's largest maritime cluster and ranks fifth in terms of global exports, with 70 percent of GDP resulting from these exports. For many local oil and gas companies, even more than 70 percent of business is destined for beyond Dutch borders.

Bruno Chabas, CEO, SBM Offshore

Royal Dutch Shell has embodied this Dutch ethos since 1907, and the company's office in the Hague hosts Shell's international upstream business and one of Shell's three global research labs. As Dick Benschop, president director Shell Netherlands, explains, "many new innovative developments in Shell often have Dutch origins, such as gas-to-liquids, which started in 1973 in the lab in Amsterdam and was developed into the Pearl GTL plant in Qatar, from where products are now coming back to Rotterdam. Another example is the Prelude FLNG facility, which is destined for Australia, and is currently being built in Korea by Samsung Heavy Industries: the first design and some of the testing of water conditions were done in the Netherlands."

Australia, with its LNG developments, is one area where the intrepid Dutch are flourishing. The Shell Prelude FLNG will be the world's first FLNG development and the largest floating offshore facility in the world, with 260,000 tons of steel used to complete the facility. More than just massive for Shell, this project provides business for a host of other Dutch innovators, such as SBM Offshore. This leading player in the FPSO market "was actually started through a patent of a mooring system for the world's first FPSO for another Dutch flagship, Shell," according to CEO Bruno Chabas, and is now supplying a large complex turret mooring system, which itself is as large as the Statue of Liberty, to Shell's landmark Australian FLNG venture.

Lammert de Wit, general manager, Balance Point Control

For other LNG developments in Australia, companies like Heerema have "built Aegir, an extremely versatile vessel for (ultra) deepwater markets, currently active on the Ichthys LNG project in Australia, and performing better every day," notes Klaver, the company's CEO.

The Far East has been a Dutch target since the heyday of the VOC (Dutch East Indies Company), and today Dutch energy players are actively expanding their Eastern footprint. Balance Point Control has a strong in-house engineering team that can provide rapid and complex solutions for well interventions as "a fire brigade for

THE PIONEERING SPIRIT IN EDWARD HEEREMA'S OWN WORDS

It is difficult to truly grasp the scale of the world's biggest ship. It is nearly as long as the Empire State Building and uses as much electricity as the Dutch town of Delft (population: approximately 100,000). The marine behemoth arrived at Rotterdam harbor early this year and is set to begin its first project in the North Sea before year's end. The man behind the PS, Edward Heerema, president of Allseas, explains his labor of love:

"The vessel is novel in every respect – with a lift capability of 48,000-tonne for topsides and 25,000-tonne for jackets, as well as a 2000-tonne tension capacity S-Lay pipelay system. The PS is not only large – at 382 meters long and 124 meters wide - but the idea of implementing motion compensation on that scale has never been done before. We also had to make the system versatile enough to accommodate a wide range of applications including large and small platforms, deep and shallow waters, jackup rigs, and topsides. To integrate such a degree of flexibility into every aspect of the design process creates its own challenges. Thanks to a collective effort over the years, the Allseas team has been able to successfully execute this engineering feat and introduce the PS to the world."

Europe." It is now looking to spread its model of technical excellence globally, alongside mother company Superior Energy Services. "Through joint-venture operations, we're currently working on several long-term contracts in Africa and the Middle East. We're already established ourselves in Thailand within the past two years, but now we're looking to further expand our presence in Asia with a regional office in Kuala Lumpur," details general manager Lammert de Wit.

Jan-Pieter Klaver, CEO, Heerema Marine Contractors

"Asia and Africa, which have traditionally sat at the lower ends of the market, now encompass the same level of quality, capabilities, and regulatory requirements as tighter jurisdictions such as the UK or Norway, certainly when the international oil companies are involved," claims Hugo Heerema, president and CEO of Bluewater Energy Services, an innovative Dutch FPSO company. Dutch service providers are thus taking their high-end expertise to new markets, as they advance in terms of technical difficulty and maturity.

Hugo Heerema, president and CEO, Bluewater Energy Services

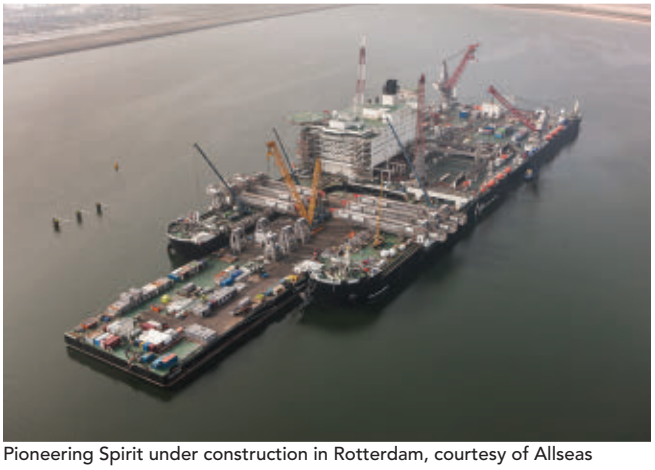
"Bluewater is turnkey supplying two very large turret mooring systems to Saipem for Total Angola's Kaombo FPSOs. Our efforts have not only focused on developing technology on the back of a project, but also individualizing our specialties to bring some truly unique patents to the market, whether it's in the areas of LNG loading and offloading systems or floating production and storage facilities," details Heerema.

Edward Heerema, president, Allseas

Even more exciting than Africa for Bluewater is the Gulf of Mexico, which has seen a resurgence of activities with the opening up Mexico's oil and gas industry to valued-added outside expertise. Bluewater's consistent positioning as a technology leader for the FPSO market has it poised for new opportunities in this effervescent market. "We're actually now close to signing a contract in Mexico, where our FPSO will be operating on a ten-year basis with production activities spanning 20 different wells, averaging half a year stay per well. In these cases where installing mooring systems for multiple half year productions incurs massive capitalized costs, DP serves as the more cost-efficient and economical method for production," adds Hugo Heerema.

Nonetheless, all of these exotic locales should not distract from

FPSO Munin, courtesy of Bluewater Energy Services



Pioneering Spirit under construction in Rotterdam, courtesy of Allseas

the continued Dutch commitment to the region where the Dutch have grown and refined their expertise – the North Sea. This holds all the more true today as the decommissioning market heats up.

As Jan-Pieter Klaver explains, "the North Sea has been extremely important for Heerema, both throughout its history and in recent times, having gone through something of a revival over the last five years. We expect the North Sea to continue to be an important basin for our activities, not just in green field projects but also in decommissioning. The knowledge and experience that Heerema has built up in the North Sea are crucial to our global activities: as one of the most difficult environments on the planet, we can transfer the knowledge gained here to other markets." Meanwhile players like Allseas maintain their strong presence in the North Sea through such ground-breaking vessels as the Pioneering Spirit and the Amazing Grace, slated to be delivered in 2021.

Bluewater Energy Services, another traditionally strong North Sea player linked to a Heerema brother, secured the engineering, procurement, construction, and integration contract for the turret and mooring system of the UKCS Rosebank field FPSO in late summer 2015. Measuring 80 meters in height and 34 meters in diameter, this turret and mooring system will stand as one of the largest in Bluewater's history.

A NETHERLANDS BASE FOR HALF THE GLOBE

Mikhail Blekherov, president, CRC-Evans Onshore East

The Netherlands is equally an attractive destination for international companies looking to base regional and global operations. For example, US pipeline expert CRC-Evans has chosen to base its onshore operations for the Eastern Hemisphere out of Zeewolde due to the country's favorable operating environment from accommodating tax regimes, efficient logistics network, and customs-friendly borders, as well as its regional accessibility.

As president Mikhail Blekherov explains, "the purpose of the Dutch facility is to consolidate our operations in the Eastern Hemisphere, acting as a center of excellence built for purpose about one year ago, with satellite offices in regions such as the Middle East, Australia, and Asia. Although there is an absence of projects in the Netherlands, we're heavily involved in several other key locations such as Turkey for the Trans-Anatolian gas pipeline (TANAP), France for GDF Suez work, Australia for APLNG and QCLNG, as well as other countries with massive infrastructure investments such as Saudi Arabia, Algeria, Russia, and China."

Finally, it is not simply in the upstream that Dutch companies flex their global muscle. Dutch independent storage provider VTTI has spread its brand of Dutch service to Manhattan, which Dutchmen will gleefully inform you was once New Amsterdam.

"We filed for an IPO with the SEC to be able to take advantage of the strong and experienced investment base for the midstream market in the US, and, in the process, we have become the first global terminal MLP company in the US. There are massive growth opportunities available globally in a very fragmented midstream market, and VTTI decided to undertake the IPO to help bolster our role in facilitating more consolidation," says Rob Nijst, CEO of VTTI.

Royal Vopak has also focused major efforts abroad, not far from Malacca, the key Asian trading port the Dutch conquered in 1641. Today the Dutch independent storage leader has expanded its network via the Pengerang Industrial Complex (PIC) at Malaysia's Southernmost tip. The PIC is Malaysia's first independent terminal complex and is located in the same development zone as the currently under construction Petronas Refining and Petrochemical Integrated Development (RAPID) complex. "We've proven that the location is indeed very suitable," argues Royal Vopak CEO Eelco Hoekstra. "We see this as a major step in our development in Southeast Asia. We now have land available for further growth, and if we have our way in the next decade, it will serve as a tactical asset in our expansion efforts moving forward."

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DOWNSTREAM DOMINANCE

The strength of the Netherlands downstream industry extends well beyond Dutch borders, in large part thanks to fortuitous geographic positioning. The Netherlands, and more specifically the Port of Rotterdam, serves as the gateway to Europe. "Approximately 75 percent of products being consumed in Europe pass through the Amsterdam Rotterdam Antwerp (ARA) region, and more specifically Rotterdam with its extensive links to the hinterland," explains Nijst.

According to the EIA, the Netherlands was the number one world importer of refined petroleum products (at 1.84 mb/d) and the number two exporter (at 2.09 mb/d) in 2013. Within this model, oil refining and storage is centered around Rotterdam and supported by such players as Royal Vopak and VTTI, while gasoline storage is focused in Amsterdam with players like Oiltanking.

Given the unique positioning of the ARA, independent terminal companies are keen on re-enforcing their presence locally. "Our key priority is to continuously expand on our existing sites. We have been doing this recently in Antwerp and Rotterdam, where we commissioned new projects to keep our facilities up to high industry standards and to thus yield higher returns," explains VTTI's Nijst.

But as Peter van Wessel, regional director of Oiltanking Europe, points out, "the Netherlands hosts perhaps an overcapacity of tanks in ARA, with many of them beginning to age past their useful life. The


Eelco Hoekstra, CEO, Royal Vopak


Rob Nijst, CEO, VTTI


Jared Pearl, CCO, VTTI


Peter van Wessel, regional director, Oiltanking Europe

first generation of these tanks was built in the 1970s, with the last generation built a few years ago, but there are even older fixed assets built in the 1950s and 1960s as well. Combined with changing legislation regarding tighter emission controls and safety and environmental regulation, the older terminals need to invest a lot of money to keep up. With such constant capital-intensive maintenance, consolidation in the industry is inevitable."

VTTI is prepared for market consolidation in the ARA and beyond following their successful IPO. The company has strong growth momentum since its creation in 2006, advancing from zero to eight million cubic meters capacity and now operating in 11 countries across five continents. In addition to the speed of its ascension to the ranks of the leading independent storage companies, "VTTI's unique selling point is the flexibility and efficiency we offer to best service our clients and stakeholders," proudly affirms Nijst. "Indeed, we started this company by designing our terminals based on the stringent requirements of one of the most demanding traders in the world and based on our clients' trading ventures. For this reason, we possess many capabilities around blending, pipeline diameters, and pumping that collectively constitute flexible and efficient operations, while the company's overall culture has grown around this trader spirit that shapes our accommodating approach towards customers."

The Netherlands is not only a major storage provider with approximately 210 million barrels of storage capacity—more than 170 million barrels in Rotterdam alone—but also a major petroleum liquids refin-

Map of ARA Region, courtesy of VTTI

A DUTCH FAMILY SPIN ON PRIVATE EQUITY

Roderik van Seumeren, managing partner, MeeMaken

MeeMaken is a unique mixture of private equity fund and family owned company that is steered by Roderik van Seumeren and Natasja Sesink. MeeMaken "basically means 'wanting to be a part of it,'" explains van Seumeren, who founded the fund in 2012 with the initial ambition to bring together ten companies by 2022. As of today, the fund includes four investment vehicles – heavy-lift engineering company Euro-Rigging, pipeline specialist Selmers, hook lifting expert Alltec Lifting Systems, and online digital learning solutions provider BeOne Development Group.

"One of our focuses within each new company is to add all associated support functions to ensure smoother operations. For example, we will implement human resources, IT, finance, or a training department to strengthen companies beyond their core technological capacity," explains Sesink.

"Our added value encompasses two factors: from an operations standpoint, we're capable enough to run the company, and from a business development perspective, my network, through years of experience in the industry, can produce a fluid stream of opportunities whether it's for contracts, strategic partnerships, or general collaborative opportunities," continues van Seumeren.

Natasja Sesink, operational partner, MeeMaken

Given its hybrid status between a family company and a private equity fund, MeeMaken considers "financials important, of course, but we see these as an outcome of a good strategy and a well-run company based on personal values. Our time intervals are much longer than a typical private equity fund, in that we grow people and companies with a genuine interest in long-term success rather than a short-term profit," according to Sesink. "We want to establish fruitful relationships and enable the long-term growth ambitions of the company's greatest assets: the people," concludes van Seumeren.

ing hub. The nation hosts five refineries, including the Europe's largest, the Shell Pernis, and boasts 1.2 million b/d of crude oil refining capacity in 2015, according to the Oil and Gas Journal.

However, the industry is facing a multitude of challenges, particularly growing overcapacity in Europe as new developments come online in the United States, Middle East, and Far East, all former destinations of Europe's refined products. Of the five refineries in Rotterdam, Kuwait Petroleum International cancelled a planned investment in its facility in 2014 and decided either to sell or convert the facility into a storage terminal. Other players, though, have reacted by pushing for gains in efficiencies and flexibility rather than divestment. As Hendrik Muilerman, CEO, BP Netherlands, notes, "the Netherlands is the best place for a refinery because this is where most of the innovative capabilities, and subsequent upgrades exist—not to mention the country's status as a regional energy hub."

Hendrik Muilerman, CEO, BP Netherlands

CHAMPIONING THE GAS AGENDA

A traditionally strong gas player with an extensive network of domestic and export pipelines, the Netherlands now faces a damaged public perception of gas due to the Groningen earthquakes, while gas' place in the energy mix has been challenged by a combination of renewables and cheap coal.

Shell's CEO Ben van Beurden told the European Parliament in 2013 that "a combination of policy and market conditions, including the availability of cheap coal and the low carbon price are leading to some unintended outcomes: the carbon reductions delivered by significant investments in renewable energy are being cancelled out by growing coal-based power generation. And at the same time, gas, a low-carbon energy source, is being squeezed out of the European power market."

Gertjan Lankhorst, CEO, GasTerra

The Dutch industry is actively championing gas as essential in the energy transition thanks to its relative environmental friendliness. Furthermore, "gas is essential in providing the flexible and cheap means of balancing the whole energy system where we see more and more sources of energy being introduced that are not flexible and that are dependent on wind or sun," asserts Gertjan Lankhorst, CEO of GasTerra, the Dutch state-owned natural gas trader. "We need a system that can cope with this unpredictability. The most effective way to accommodate all of these fluctuations is to use the dense gas grid that we have in large parts of Europe and here in the Netherlands."

Han Fennema, CEO, Gasunie

Recognizing the centrality of gas to security of supply but also that reliance on indigenous gas reserves would only go so far, policymakers and industry players have been drafting the nation's gas future for some time. The solution has been to build upon the Netherlands' world-class gas infrastructure via the 'Gas Roundabout' concept. "Initial foresight of dwindling supply security in the Netherlands, was in part, the reason why Gasunie, in line with the government's objectives, created the 'Gas Roundabout.' With this expansive and interconnected network of gas infrastructure, gas can now flow from multiple sources in and out of the Netherlands, whether it's from the country's own gas fields or other countries such as Norway, Russia, Denmark, and, in the form of LNG,

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from a variety of other supply areas all over the world," explains Han Fennema, CEO of Gasunie, the Dutch state-owned natural gas infrastructure and transportation company.

This Gas Roundabout includes Gasunie's gas pipelines, gas trading via the Title Transfer Facility (Europe's largest natural gas trading center in terms of spot volumes since 2014) and the ICE Endex, gas storage with such projects as TAQA's Bergermeer gas field, and the Gate terminal, a LNG transfer hub.

Industry players have now moved towards a discussion of the 'Gas Roundabout 2.0' concept, based on the opportunities for building the infrastructure around LNG and pushing the agenda for new uses of gas, as well as a diversification of gas sources and the development of a spot market. According to Shell's Benschop, the 'Gas Roundabout 2.0 concept' will also address concerns on gas, which has been slighted in the energy transition in favor of a renewables/coal mix in many European countries. Gas Roundabout 2.0 will show "how gas and renewables are going to work together as the backbone of the new energy system, which will not only be about renewables; gas will be included as well, not just as a transition fuel but as a systems fuel," explains Benschop. "The Netherlands is in a particularly interesting place for this due to its large existing gas infrastructure and knowledge base, and the fact that the country is developing renewables today on a much larger scale than before. We are figuring out how to combine all of these elements, and how the Netherlands can be used as a lab to test how this new energy system will actually function."

All of these gas initiatives have a keen importance, as "the Netherlands is the fourth largest gas consumer in the EU after the United Kingdom, Germany, and Italy," according to Robert Goevaers, director of the National LNG Platform. This platform's ambition is to reach 50 seagoing ships, 50 river going vessels, and 500 trucks running on LNG by the end of 2015.

LNG'S TIME TO SHINE

LNG celebrates it 51st birthday in 2015, but the Netherlands does not consider the concept as over the hill at all. According to Royal Vopak CEO Eelco Hoekstra, "LNG was four percent of global gas trade, and now it has reached ten percent. If it reached ten percent last year that means it is on the rise and has been continuously rising. Several factors contribute to the appeal of this fossil fuel, especially the sheer availability of gas worldwide and the price at which it can be produced in certain countries… It will indeed take a while to build up the asset base, especially when considering the capital-intensive nature of LNG. But if the evolution of oil throughout history is any indication, the commoditization of gas will likely continue over the next 20 to 30 years at least."

Bas Hennissen, vice president industry and bulk business, Port of Rotterdam

LNG is becoming a larger part of day-to-day life locally with its increasing small-scale use as a transportation fuel, in order to reduce CO_2, NOx, SO_x, and particle emissions. With a lower LNG price and more than enough LNG supply at the moment to cover demand, the Netherlands is betting on importing LNG and using it to servicing local markets thanks to highly-developed local infrastructure.

Coby van der Linde, director, Clingendael International Energy Programme

In 2011, the Gate terminal was launched as the Netherlands' first LNG import terminal, boosting the Port of Rotterdam's ambition "to become the number one European import, export, and bunkering hub for LNG," according to Bas Hennissen, vice president industry and bulk business at the Port of

Royal Vopak Terminal Europoort, courtesy of Royal Vopak

Rotterdam. According to Coby van der Linde of the Clingendael International Energy Program (CIEP), "the whole idea of the 'Gas Roundabout' is to create a logistical nexus here in the Netherlands. In terms of gas, the objective is to create optionality in the system. The model for the Gate terminal means that players have the capacity to import LNG if they desire, for retail here or in wider markets."

"Decreasing production from resources, including Groningen obviously has implications for Rotterdam's ambition to be a 'Gas Roundabout'. Falling production has huge geopolitical implications for the Netherlands, including where we source gas. The Gate terminal gives us further options in that regard. Investments in LNG developments are continuing – it is likely that the LNG terminal will become of increasing importance as gas reserves fall," argues Cees Jan Asselbergs, director of Deltalinqs, the association for logistics, ports, and industrial enterprises in Rotterdam.

Cees Jan Asselbergs, director, Deltalinqs

A major step forward has been Royal Vopak and Gasunie's LNG break-bulk facility launched at the Gate terminal in early 2015. "The break bulk facility aims to increase the distribution and use of smaller scale LNG services," explains Fennema. "This is the first, in what we hope, of many break bulk facilities for maritime vessels and industrial vehicles that will be developed along the shores of the North and Baltic seas. In the context of the energy industry's overall supply security, small-scale LNG shipments effectively create opportunities for those not connected to gas grids to leverage LNG, as a cleaner and more cost-efficient transportation fuel alternative to oil."

Shell is banking on a strong gas agenda, bolstered by its proposed acquisition of BG Group and its FLNG. It is also "working to develop LNG as a transport fuel across the value chain, the first

steps of which will be heavy road transport and barges. We will be opening our first LNG filling station for trucks in March in Rotterdam, and two years ago, we took the initiative to order two LNG-powered barges, newly built here in the Netherlands… The next step will be initiating LNG in the maritime sector – we have an agreement for a break bulk facility here with Gate terminal and will be the launch pad customer for this facility. We are also looking at ship-to-ship bunkering as well," notes Benschop.

Ben Oudman, country manager oil and gas, DNV GL Netherlands

The supporting services industry is concurrently gearing up for this shift towards greater LNG use. "Our Dutch DNV GL teams have an abundance of insight and experience with LNG as transportation fuel, and we have positioned ourselves as a leader in the developing local and international market for what is often called downstream LNG," says Ben Oudman, country manager Netherlands and head of gas consulting and services at DNV-GL.

"We are the safety risk advisor to the Dutch LNG Platform, while we also perform most of the quantitative risk assessments related to LNG for the Port of Rotterdam, Royal Vopak, and GDF Suez, among other companies. Our expertise has made us the preferred safety risk advisor pertaining to the sighting of LNG fueling stations for road transport and bunkering facilities for inland vessels," continues Oudman.

First 100% LNG-fuelled barge, Greenstream, launched in 2013, courtesy of Shell

Indeed, this focus on LNG puts the Netherlands and companies active in this evolution at the center of European policymaking in this area. Oudman concludes, "given the leading position of the Netherlands regarding downstream LNG, our Dutch teams are currently also involved in the EU LNG Masterplan, setting the standards for the introduction of LNG as fuel within Europe."