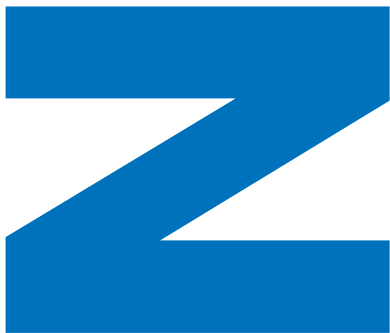


vol. 21 - no. 2 - 8 April 2004



SUBSEA ENGINEERING NEWS

PLANS FOR PLATFORM SHELVED

HYDRO COMMITS TO SUBSEA COMPRESSION FOR ORMEN LANGE

From Oslo: Norsk Hydro, which has been one of the leading proponents of advanced subsea technology for more than a decade, has again hitched its wagon to an as-of-yet unqualified piece of equipment and rejected plans for what would be the deepest offshore platform in home waters.

On the day before the operator received the formal go-ahead from the government for its important *Ormen Lange* gas development (SEN, 21/1), Bengt Lie Hansen, the acting head of E&P Norway, told a gathering here last Thursday evening that Hydro has opted to focus on the development of subsea compression for the second - ie reservoir support - phase of this project.

Hansen said 'there will be no platform' on the *Ormen Lange* field which lies in water depths ranging from 850m to beyond 1,000m. The deepest existing facility in Norwegian waters is the *Norne* fpro in 380m.

Amongst the technology projects carried out by Hydro in the past

was the development and deployment of the *TOGI* subsea system in 1991, Norway's first deepwater (300m+) installation and the longest subsea tieback (48km) for more than half a decade. Nearly a decade later it installed the *Troll Pilot* subsea separation and water injection system, the first full-scale operational system of its type in the world.

According to Hansen, the licence group has already begun study work on this new technology which would eventually lead to the assembly of a prototype system. It will be tested at the *Ormen Lange* onshore terminal at Nyhamna and subsequently be prepared for installation offshore by 2016.

Hansen also suggested that this technology might be available for use on the giant *Shtokmanskoye* gas field, offshore in the Russian Arctic. At the moment, though, it is believed that *Shtokman* is not at the top of operator Gazprom's development list.

- Mooring/anchor connectors
- Riser tie-down systems
- Pipeline recovery
- Coil tube handling
- Pipeline/umbilical repair connectors

e: sales@bswlttd.com
w: www.bswlttd.com

WHAT'S INSIDE

- *Kristin* is no fairy tale, 3
- Cal Dive readies commando raid, 4
- Statoil and FKS don gloves?, 6
- Whose finger is in what hole?, 8

M.S.C.M.E

SUBSEA MANUFACTURER

- VALVES ●
- COUPLINGS ●
- MANIFOLDS ●
- STAB PLATES ●

Email: sales@mscmltd.co.uk
Tel: +44 (0) 1628 488361

SEN has also learned that the licence group has made some provision in the plans for the first portion of the *Langeled* gas export system to accommodate production from third party fields. The first part of the pipeline - 42in from the terminal to the *Sleipner* complex - will operate at 210bar and would have a capacity of 70mcm/d.

This could be increased by raising the operational pressure, SEN has been told. In order to bring other gas into the system, an unspecified number of pre-installed tees will be put in place to simplify later tie-ins.

Ormen Lange is expected to have a capacity of up to 80mcm/d from its eight phase one wells. This will be achieved through the use of 9.625in completions, the largest ever used in subsea wells.

Trenching

What must be the last of the construction contracts to be let was awarded to Nexans last week for trenching and burial of the umbilical and pipelines. Nexans has built a new water jetting system to operate on the

hard soil conditions here. The system was designed and built in-house.

While this €24mn contract is significant, Nexans will be putting in an even greater effort on the umbilical award which is not due until July. The main field umbilical will be in excess of 100km plus infield jumpers.

Equally of note is the rockdumping work which will be carried out by Van Oord, formerly known as Van Oord ACZ. This will be the deepest and most challenging rockdumping project carried out anywhere.

The previous depth record was on the Straits of Gibraltar gas pipeline line in 900m, but that was on bedrock. The seabed is considerably softer here.

VO will have to spread a wide berm to cover the seabed routes for both pipelines to shore and the main field umbilical and build up a filter layer of varying size of material to create a level lay area. The work will be done by the fall-pipe vessel *Tertnes*, sister ship of the *Rocknes* which was damaged last year in Norwegian waters.

NORWEGIAN TAX CHANGES ON INDUSTRY WISH-LIST

From Norway (NT): Hopes are high in Norway that the government will make proposals to ease the tax burden on the offshore sector in the revised budget which is due to be presented to the Storting on 11 May.

In fact the Ministry of Finance (MoF) has privately committed itself to taking action, although without intimating what this might be. It is responding to a series of reports which have been delivered to it by Kon-Kraft, the cross-industry consultative body charged with finding ways of keeping the Norwegian sector competitive.

Kon-Kraft has made two main proposals concerning the 50% special tax to which offshore activities are subject - which when added to the standard 28% corporation tax brings the marginal tax in Norway to 78%.

First it would like the special tax reduced for new developments. It has not specified by how much, but examples in its tax report are based on a 50% reduction in the tax which suggests what it would like to see. Secondly

it proposes that new investment made on fields already in production, eg to drill new wells or install greater water-handling capacity, the nominal oil price on which tax liability is calculated should be reduced.

Kon-Kraft, which is lobbying hard for action in political and other stakeholder circles, wants to see the changes backdated to the beginning of this year. Its proposals are understood to enjoy the backing of the Ministry of Petroleum & Energy which has two officials on its working committee.

Crisis

Tax changes are one of the measures needed to avoid the crisis facing the oil industry in Norway, Kon-Kraft says. According to the government's own forecasts, investments are set to fall by half by 2007-08. Action is required to stimulate both investment and exploration and reduce high cost levels.

One of the findings in Kon-Kraft's recent report on costs was that rig rates in Norway

are on average \$30K/day higher than in the UK sector, contributing to higher well costs.

Meanwhile the Norwegian sector will benefit, along with the rest of the indigenous industry, from proposals to ease tax on dividends and

the sale of shares. Although for tax specialist Ernst & Young this move indicates that 'Norway leads the way in North Sea tax reform', it is a reduction in the special tax that is at the top of Kon-Kraft's - and the industry's - wish-list.

NORWEGIAN NOTES

From Norway: You might not have realised it, but there is an ongoing Norwegian conspiracy. It involves the Ministry of Petroleum & Energy, the Norwegian Petroleum Directorate (NPD) and the two big indigenous operators, Statoil and Norsk Hydro.

They have all been issued flags, banners, bullhorns and maps and have agreed to go around telling everyone that the next great Norwegian exploration play is in the **BARENTS SEA**. And for those who don't know where that it is, show them the maps.

This might seem like a joke, but it isn't. Of course, the Barents Sea is not exactly new. Statoil is working on the first European liquefied natural gas (LNG) project based on feedstock produced subsea from the *Snøhvit* field. In case you didn't know the name is Snow White in English, but this isn't a fairy tale. There is also *Goliath* (Goliath), a Norsk Agip oil find in the sensitive northern waters, but, no, this is not a biblical parable either.

It just seems like a big plot to convince the industry that the Barents Sea is the next place to bring their drilling rigs, because recent exploration in domestic waters, notably the Norwegian Sea, has been duff. Statoil has already announced a four-well drilling programme next autumn, but it is part of this conspiracy as well.

Does this have anything to do with April Fools Day? SEN leaves it to your imagination. But don't try to telephone anyone in Norway to find out the truth, because they have all gone away skiing for Easter.

Subsea Systems
ENGINEERING
COURSE

Houston • 27-29 April, 2004

The **Subsea Systems Engineering Course** has been designed to provide an overview of all of the key processes, technologies and equipment that comprise contemporary subsea production developments.

Organized by *Subsea Engineering News* and *Clarion Technical Conferences*.

Complete details online at WWW.CLARION.ORG or call +(1)713.521.5929

One project that is not a fairy tale with a happy ending is **KRISTIN**. It has been well reported that Statoil, while drilling the first production well, has found the high pressure and temperature reservoir 'more challenging' to drill than expected, although the issues apparently do not relate specifically to the environmental conditions.

The result is that Statoil will have to drill more expensive horizontal wells to access all of the reserves to make this project profitable. This is expected to add NOK1-2bn - or up to £170mn - to the budget. This is not supposed to delay first production - due 1/10/05 - but a more formal announcement is due to be made after the Easter break.

As reported here before (SEN, 21/1), *Kristin* has also proven to be more challenging - there are no longer 'problems', just 'challenges' - for Kvaerner Oilfield Projects which is providing the production hardware for this hp/t project.

Even after all this time - the contract was awarded two years ago - questions continue to be raised on how KOP managed to win this job, considering that it was running behind the competition - ABB and FMC - in qualifying hp/t equipment. Nonetheless KOP has laboured long and hard on the qualification programme which, SEN has learned, has continued to grow. It is now up to 55 components in the production system.

In addition, at a very late date, Statoil made changes to the tree configuration, adding five more valves, mostly of the 0.5in gate type, for downhole functions. On the plus side, Statoil has already picked up the first option in the contract increasing the number of trees to 11 with two more optional.

One unusual design feature of the xmas tree is that the entire choke module is retrievable rather than the more usual insert portion. A

number of vulnerable items - including sensors for erosion, temperature and pressure - have been grouped together in the module, so that when anyone fails, the entire unit would be retrieved for inspection.

Also of note is the design of the template-manifolds. The installation sequence for the structures is: install the template, drill the wells, fit the manifold and then put in the xmas trees. This is somewhat unusual for the North Sea where multiple installation operations are usually avoided due to difficult weather conditions.

Much has been made of BP's work with Cameron (SEN, 21/1) on an **ALL-ELECTRIC CONTROL SYSTEM**. More quietly, FMC Kongsberg Subsea has been working on some similar equipment for Statoil. This has included electric actuators for both subsea chokes and gate valves. FKS has suggested that an all-electric control system would reduce the cost of a subsea umbilical by 50% by eliminating the hydraulic elements.

Angola is one of the offshore sectors from which **NORSK HYDRO** hopes to increase its international production, but not, it seems, from Block 34. This much-sought-after licence area, where Hydro was named technical adviser to Sonangol, has proven to be a disappointment. Although it has drilled only one unsuccessful well, the geology there is said to be 'unpromising'.

While on Hydro, the manifolds for its **ORMEN LANGE** project are monsters. They are 45m by 33m by 14m and weigh in at 1,200t. These must be the biggest subsea structures for more than a decade since the days of the *Snorre Production System*.

One thing that is rarely in short supply in Norway is honesty. So it was no surprise that Alfred Nordgård of Norske Shell, who is involved in the **OG21** R&D strategy initiative admitted that the *Demo 2000* technology demonstration scheme was launched back in 1999 without a proper strategy. The OG21 strategy now includes work on three key subjects - deepwater floaters, long-distance wellstream transport and seabed (and downhole) processing.

NPD has calculated that 75% of remaining **RESERVES** here are less than 50km from existing infrastructure and in less than 500m...The Norwegian Continental Shelf **UNDER-EXPLORED**, according to just about everyone. While there have been 2,800 wells drilled historically in UK waters, there have been just 600 drilled in the Norwegian sector...**HALLIBURTON** has supported Norsk Hydro in drilling 23 multi-lateral wells on the *Troll Olje* field including seven trilaterals with one with five branches...Drilling contractor **SMEDVIG** is avoiding the subsea well intervention market. CEO Kjell Jacobsen said his company would not spend money speculatively to either develop new technology or build a vessel.

PROJECT UPDATES

CAL DIVE EYES MOVE INTO THE NORTH SEA

Cal Dive International which acts as both a subsea construction contractor and licence holder in the Gulf of Mexico is looking to repeat that formula in the North Sea.

Owen Kratz, Cal Dive's charismatic CEO, has reportedly told analysts that his business strategy for 2004 is to move his mainstream business into the Far East construction market and look for licence-holding opportunities in the UK sector of the North Sea for Cal Dive's production subsidiary, Energy Resource Trading (ERT).

There was no mention of expanded construction activities over here, but that is first on the agenda. Canyon Offshore, a Cal Dive subsidiary, is working on the development of a portable reel-lay system for rigid pipelines up to 6in that would be deployed on its construction vessel *Northern Canyon*. The design and fabrication of the reel and the ramp is being carried out by Aquatic Engineering & Construction.

The only missing element in this package is diving support and that it seems might be provided by Well Ops Ltd, another Cal Dive

subsidiary, using *Seawell* when it is not carrying out subsea well intervention.

From Houston (RV): Using its open-water intervention riser system, Cal Dive subsidiary Well Ops Inc has completed subsea well intervention (SEN, 21/1) on ENI's *Yosemite* (Green Canyon 516) and *King Kong* (GC472) fields in the Gulf of Mexico.

The contract was performed from the msv *Q4000* vessel in 1,160m. To provide well access, pressure control and the capability for emergency disconnect, the 7.375in through-bore intervention riser system (IRS), which

allows access to both vertical and horizontal trees, was deployed and connected to Cameron horizontal trees via a 6.625in Hydril tubing riser and a rigid 2.375in tubing annulus line.

Slickline was then used to control the sliding sleeves of the completion for zonal isolation and opening of the new production zone. In addition, to further reduce pipe handling time, Well Ops left the IRS deployed subsea while moving *Q4000* 2km between the wells. This saved roughly two days of operating time. Cal Dive said the IRS was in operation during the programme for a total of 21 days.

MAURITANIA PLAY HEATS UP

From Houston (RV): The West African nation of Mauritania is quickly joining the ranks of its neighbours to the south as a prospective deepwater province.

To date Woodside has recorded four major deepwater discoveries – the 100mmbbl plus *Chinguetti*, the country's first deepwater find and also most likely its first offshore development (see below) and the nearby *Banda*, *Tiof* and *Tiof West* finds that together are thought to hold as much as 300mmbbls.

While these discoveries have indicated an offshore oil play, Dana Petroleum said its late 2003 deepwater *Pelican* find in Block 7 now shows signs of gas reserves as well. *Pelican-1*, the first well in the block, was completed in late December in 1,675m. It targeted a Tertiary target and was drilled to a total depth of 3,825m encountering oil and gas shows from approximately 3,400m to TD with no water-bearing sands seen below the hydrocarbon interval.

Very gassy

Dana said the preliminary assessment indicates two significant gas accumulations with minimum thicknesses of 150m and 40m, respectively. Based on early calculations, the data suggests approximately 28bcm in place with recoverable reserves estimated in the range 17-22bcm and 10-13mmbbls of associated liquids.

The company said this 'significant volume of gas' is likely to become commercial as experienced LNG players become involved. It

added that once the post-well technical work is complete it will return to *Pelican* for more drilling, but in the meantime plans are to drill a well in Block 1 later this year where two prospects have been identified with combined potential reserves of 500mmbbls.

From the UK (NP): Woodside says that it has now decided that the fpso for *Chinguetti* (SEN, 21/1), will be leased under a service contract and owned and operated by a specialist fpso contractor.

Approval by the joint venture to proceed with development is expected before mid-year. Negotiations are well underway for the SURF (umbilicals, risers, flowlines) contract and development drilling. Subsea hardware is likely to be supplied under Woodside's frame agreement with FMC. The operator expects to award major contracts around the final investment decision.

From London: BG has completed acquisition of Hardman Resources holdings in Mauritania for \$132mn plus a \$5mn contingency payment. The deal covers stakes in PSC A and B which cover offshore blocks 3, 4 and 5 and include the three Woodside-operated finds.

NEW BOOK! Complete details online at WWW.CLARION.ORG or call +1(713)521.5929

Subsea Pipeline ENGINEERING

Prof. Andrew C. Palmer and Dr. Roger A. King

This major new reference work is distilled from the authors' vast experience in industry and their world-renowned course on Marine Pipeline Engineering.

*175. April 2004 • 650 pages, hardcover • ISBN 1-59370-013-X Use Express Code SEN when ordering.

PROJECT BRIEFS

From the UK (NT): Venture Production has submitted an environmental statement for the first stage of the further development of its newly acquired greater *Kittiwake* area.

The plan includes development of the **GADWALL** field and a new water injector on **MALLARD**, where the existing injector is proving ineffective (SEN 20/22). A tender was issued recently for a semisub to re-enter and recomplate the 1996 *Gadwall* discovery well and drill the *Mallard* injector. Depending on the results of *Gadwall* production, a water injector may also be drilled on this field.

In October a subsea contractor will replace the removable flow spools fitted on the 15km 8in production and injection flowlines running from *Mallard* to *Kittiwake* with tees to allow the tie-in of the new wells. The *Gadwall* well will be connected to the tee by a 75m flowline. It will be controlled through a 3km umbilical running from the *Mallard* umbilical termination assembly. At some future date Venture intends to install a pigging loop on the *Mallard* production line, which to date has not been pigged.

As far as hardware goes, Venture has little choice. Shell UK Expro, which sold these assets, used ABB Vetco Gray xmas trees and a Kvaerner Oilfield Products control system on *Mallard*. Venture will have to conform for the *Gadwall* well.

Statoil's proposed **SUBSEA WELL INTERVENTION** programme (SEN, 20/21) planned for this summer may yet not happen. The tender, won by Well Ops with *Seawell*, was based on vessel availability, not the intervention package, so FMC Kongsberg Subsea was not able to directly bid its RLWI system (SEN, 20/17), developed primarily for Statoil's requirements.

SEN has been told that Well Ops, despite having won the tender, does not have an interface for the ball valves which sit atop FKS' horizontal trees that it will be working on nor does it have an interface for the FKS control system.

And, apparently, SEN has learned that FKS is disinclined to provide the equipment to allow

Well Ops to carry out the work, having told Statoil that the patent for the interface is part of the intervention package not the xmas tree. Statoil has bought upwards of 100 such trees over the last decade for such projects as *Asgard* and *Gullfaks Satellites*.

Could it be that FKS is more than a little peeved at Statoil over losing this intervention programme to Well Ops? FKS spent in excess of \$25mn developing its riserless light well intervention system and has been shut out of using it, because of the way Statoil bid this recent work programme.

There is an alternative for Statoil and Well Ops which is to remove the ball valve and replace it with conventional tree cap and a well insert. This will be an interesting battle of wills between the world's second biggest operator of subsea trees and its biggest hardware supplier.

From the UK (NT): Drilling is under way on the **BROOM** development (SEN, 20/xx), where Lundin has replaced DNO as operator. In late March, the semi *Sedco 704* began a programme which involves drilling the tophole of one of the water injectors and the second injector to TD. In late June *GSF 140* will arrive to recomplate three appraisal wells as producers and finish the first injector. First oil is expected in July.

From Houston (RV): After winning the pipelay last year for BHP's *Angostura* project, Stolt Offshore is expanding its presence offshore Trinidad & Tobago (T&T) with work for two other operators off the two-island nation.

Last week, Stolt received a letter of intent from the National Gas Company of T&T to install 63km of 36in gas pipeline from the BP **CASSIA B** platform to Trinidad's southeast coast. The job is valued at \$50-60mn.

That same day the company also announced an \$80mn contract from BG on its *Dolphin* development off Trinidad's east coast. This job will involve installation of 90km of 24in gas pipeline and an associated 12in infield flowline and umbilical that will take gas from the *Dolphin* platform to the Beachfield onshore facility. Offshore installation for both

will be in the second half of 2004 with *DLB801* pipelay barge performing the work.

Stolt has also picked up phase two of Total's *Amenam* development, offshore Nigeria. The \$150mn EPIC contract is for the jacket and topsides for water injection platform to be built at its Globestar yard in Warri. It also includes installation of a 60km 24in gas export line and a 2km 18in pipeline to link the new platform to a process platform being built by Saibos. Installation begins in 2005.

Subsea 7 has picked up the \$40mn EPIC contract for Norsk Hydro's **OSEBERG**

VESTFLANKEN subsea satellite project. The scope includes the installation, trenching and rockdumping for a pair of 9in 9.7km rigid flowlines plus the integrated service umbilical. *Skandi Navica* will handle this job. S-7 also has an option for phase two of **TUNE** which involves a 3.2km 8in flexible and umbilical.

Saipem has been awarded the installation of the 370km offshore pipeline - linking Qatar and United Arab Emirates - that is part of the **DOLPHIN** project...Torch Offshore's new pipelay conversion **MIDNIGHT EXPRESS** is due out of the Davie Maritime shipyard in Quebec in late May.

FLOATER BRIEFS

From Houston (RV): Kerr-McGee's cell spar, the industry's first, has been upended and connected to the six-leg polyester mooring system on the **RED HAWK** field (SEN, 20/24) in 1,615m on Garden Banks 876. The hull set sail from Ingleside, Texas in mid-March for upending and hookup. Topsides installation, which is being performed by Heerema's *Balder*, is now underway.

All subsea wells have been pre-drilled on neighbouring GB877 and will be tied back to the spar with two subsea wells coming onstream this quarter.

With the hull installed, *Red Hawk* marks the second application of a polyester mooring system for a permanent installation in the Gulf of Mexico following BPs *Mad Dog* spar.

Technip, in joint venture with Fel Setal, will provide the fpso *Petrobras 51* for operations at **MARLIM SUL** (SEN, 20/23). The unit will be built at Brasfels in Angra dos Rios and another local yard. This deal was made possible by the decision to scrap the state ICMS tax cutting \$130mn off the budget.

From Houston (RV): Shell has contracted Prosafe's *Safe Caledonia* DP accommodation vessel for use in hookup and construction support at the **BONGA** fpso, offshore Nigeria. The vessel replaces *MSV Regalia* which has a six-month contract due to expire in June when it will move to the *Troll* field for Statoil in the North Sea. *Safe Caledonia* has a one-year contract with four one-month options.

Bonga was due onstream at the end of last month, but delays on offshore construction and commissioning has Shell hoping for first oil by the end of the year. The field will produce 225,000b/d and 0.1mcm/d from 21 wells flowing to the 2mmbbl capacity fpso. Oil export will be via an offloading buoy, the industry's largest, provided by SBM, with tankers shuttling crude to shore and gas being piped to Bonny Island via the *Offshore Gas Gathering System*.

Tronic is to supply its Digitron connectors to Santos' **EXETER-MUTINEER** fpso project, offshore Australia. This project features both electrical submersible and seabed pumps...Shell and BP will share the OTC technology award for the six-field **NA KIKA** floater/subsea development in the Gulf of Mexico...WellDynamics has supplied the first SmartWell system in Australia on BHP's **SCINDIAN** field which first came into production in 1994. The field produces to the *Griffin* fpso...Woodside has sold 40% of its 100% interest in the **ENFIELD** fpso development (SEN, 20/21), offshore Australia, to Mitsui for \$465mn.



TECHNOLOGY

DUTCH BOY INSPIRES PIPELINE LEAK TECHNOLOGY

From Aberdeen (BG): The story of the Dutch boy - Hans Brinker - who stuck his finger in the dyke to save his village from a flood is well known. It would be quite amazing if the writer of the story ever imagined that her hero would one day be the inspiration for cutting-edge pipeline technology.

But that's exactly what has happened. Brinker Technology is a one-year-old spin-off company from the University of Aberdeen. The company's aim is to create, develop, implement and commercialise innovative technical solutions which promote pipeline integrity in the oil and gas industry.

No big seal!

Brinker, based in the tranquil surroundings of the Aberdeen Science & Technology Park, is currently marketing ATLLAS - advanced technology for leak location and sealing - a technology originally developed in UA's Department of Engineering.

The technology utilises the fluid flow inside a pipeline to deliver specially designed 'platelets' - not dissimilar to those in human blood - to seal a leak. The 'platelets' are held against the pipe wall by the fluid forces, facilitating sealing and also marking the position of the leak for subsequent detection.

The technology is radically different to other

current approaches to pipeline integrity. It would be used as part of routine pipeline operation, causing minimal disturbance to production and avoiding costly shutdowns.

The Brinker team is looking to bring the technology forward to deal even more efficiently with pipeline corrosion, one of the industry's biggest problems. One of the issues being looked at is how to deal with small leaks in hydraulic and chemical injection lines and the team has successfully tested the sealing of 0.3mm leaks at 500bar.

The message that Iain Chirnside, the company's affable young boss, wants to get across to the industry is that it needs to 'come and talk to us about your pipeline problems. It is really important that we know what and where your problems are.'

Unfortunately, due to client confidentiality, there is very little Chirnside could say about the status of what his company is actually working on. All he could tell us was that the eight-strong Brinker team is currently working with five different international operators.



Editor: Steve Sasanow. *Correspondents:* Neil Potter, Nick Terdre (UK); George Hawrylyshyn (Rio); Robert Verner (Houston); Trevor Rees (Australia); Bob Gibb (Aberdeen).

SUBSEA ENGINEERING NEWS (ISSN 0266-2205) Including Pipeline & Floater Update is published twice monthly by Knighton Enterprises Ltd, PO Box 27, Cheltenham GL53 0YH, UK; telephone: +44 (0)1242 - 574027; fax: +44 (0)1242 - 574102; e-mail: sen@btinternet.com; web-site: www.subsea-news.co.uk.

2004 annual subscription: (electronic delivery only) £330 + VAT (where applicable), \$600 USA
Credit cards accepted subject to charges.

© Knighton Enterprises Ltd. Material may not be reproduced in any form or photocopied without written permission of the publisher.