Petroleum review

SEPTEMBER 1998

North Sea

- new technology
- new developments
- new safety initiatives

Britannia field

Crine cuts costs

Canada

Ice protection for Terra Nova

UK independents

Globalising operations

Technology

- under balanced drilling
- bioremediation

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For further details, contact:

Information Officer
Minale, Tattersfield & Partners Limited
The Courtyard,
37 Sheen Road,
Richmond,
Surrey, TW9 1AJ,
United Kingdom.

Telephone: +44 (0)181 948 7999
Facsimile: +44 (0)181 948 2435
ISDN: +44 (0)181 332 2160
Email: info@mintat.demon.co.uk
Internet: http://www.mintat.co.uk

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IP THE INSTITUTE OF PETROLEUM
A charitable company limited by guarantee
Director General: Ian Ward
61 New Cavendish Street
London W1M 8AR, UK
General Enquiries:
Tel: +44 (0)171 467 7100
Fax: +44 (0)171 255 1472

EDITORIAL

Editor: Chris Skrebowski
Deputy Editor: Kim Jackson
Production Manager: Emma Parsons
The Institute of Petroleum
61 New Cavendish Street, London W1M 8AR, UK
Editorial enquiries only:
Tel: +44 (0)171 467 7118/9
Fax: +44 (0)171 637 0086

e-mail: petrev@petroleum.co.uk

http://www.petroleum.co.uk

ADVERTISING

Alison James
Anne Marie Fox
Advertising Manager: Jolanda Nowicka
Production: Catherine Meade
Landmark Publishing Services,
8 New Row, London WC2 4LH, UK
Tel: ***+44 (0)171 240 4700***
Fax: ***+44 (0)171 240 4771***

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ABBREVIATIONS

The following are used throughout *Petroleum Review*:

mn	= million (10^6)	kW	= kilowatts (10^3)
bn	= billion (10^9)	MW	= megawatts (10^6)
tn	= trillion (10^{12})	GW	= gigawatts (10^9)
cf	= cubic feet	kWh	= kilowatt hour
cm	= cubic metres	km	= kilometre
boe	= barrels of oil equivalent	sq km	= square kilometres
		b/d	= barrels/day
t/y	= tonnes/year	t/d	= tonnes/day

No single letter abbreviations are used. Abbreviations go together eg. 100mn cf/y = 100 million cubic feet per year.

Front cover: The Britannia platform, 210 km north east of Aberdeen
Photo courtesy of Chevron UK Ltd/Conoco (UK) Ltd

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From the Editor

Sisters to wed

The announcement that BP and Amoco are to merge must rank as the most important industry news this year. It will create Britain's largest company, with revenues of $108bn and capital of $53bn, owned 60% by BP and 40% by Amoco (see p9).

BP is one of the oldest and largest of Enrico Mattei's 'seven sobbing sisters'. Amoco might reasonably claim to be the eighth sister. Although the courtship has been secretive and whirlwind – just two months – the 'marriage' shows every sign of being based on a healthy mutual self interest.

BP brings world renowned exploration skills, considerable oil reserves and much innovative offshore technology. Amoco brings great chemicals expertise (particularly outside Europe), very considerable gas resources, notably in the US, Trinidad and Egypt, and a strong US downstream presence. In addition BP has a strong reputation for innovative cost cutting with initiatives such as the BP/Mobil joint downstream operation in Europe. This is unaffected by the new merger but does raise the question of the long-term relationship between Mobil and the new BP Amoco.

Together, the two companies are much more than the sum of the parts. They form a balanced company with global assets and interests. It will be a company to challenge Shell and Exxon's pre-eminence in the business.

There is, however, another side to the proposed merger. The imperative to merge is at least partially a response to low prices and the expectation that these will continue. The merger is to be paid for by savings of at least $2bn, achieved by the removal of duplication in the combined enterprise. Job losses have been estimated at around 6,000, but financial analysts are already suggesting it could be much higher.

Currently there cannot be an oil industry boardroom that isn't looking at the impact of BP Amoco on its operations and looking for ways to improve profitability in response. A lot of oil industry jobs now hang on the rapid recovery of oil prices.

Oil prices

Prospects for a rapid price recovery, however, are not good. The latest International Energy Agency (IEA) statistics show that Opec, excluding Iraq, cut production by 780,000 b/d between June and July, a compliance rate of 56% of the 'agreed' cuts. However, Iraq increased production by 420,000 b/d from 1.86mn b/d to 2.28mn b/d between June and July which meant only 360,000 b/d was cut from total Opec production. This level of cutback is unlikely to make much impact on stocks.

The IEA reports that OECD stocks rose by 440,000 b/d in June to reach 2.8bn barrels. The price of the Opec basket of crudes reflects the price pressure: 1Q1998 was $13.35, 2Q1998 was $12.45, and the whole year to 6 August just $12.77.

As if Opec prices, production and stock levels were not bad news enough, the IEA has revised down 3Q demand by 300,000 b/d and 4Q by 200,000 b/d. Its latest estimate is that the call on Opec production will be 26.9mn b/d in 3Q and 28.6mn b/d in 4Q, both being 100,000 b/d lower than earlier estimates, while the call in 1Q1999 is estimated at an unchanged 27.7mn b/d, a level which is slightly lower than Opec's production in July.

North Sea

This issue's main feature is the North Sea. We report on the way that the technology continues to advance with the North Sea remaining the proving ground for technologies that will have global application (see p14). It is also appropriate that just after the 10th anniversary of the North Sea's greatest disaster – Piper Alpha – that we cover the latest thinking on safety issues (p25 and p26).

The North Sea has been a technical and economic triumph for both the companies and countries involved. In the last few weeks the Schiehallion field west of Shetland and the ETAP fields have come onstream (p5) adding greatly to UK sector production. They were soon followed by the start-up of the Britannia field, the UK sector's largest gas condensate field.

There are now few large UK sector fields to be developed, although the Norwegian sector still has several (see table of 1998 developments, p21). All the indications are that UK sector oil production will peak by 2000 and Norwegian by 2002. This poses a considerable challenge to the two governments. As the remaining projects become smaller and more marginal a sympathetic and stable tax regime becomes ever more important. The oil industry does not naturally attract sympathy when it comes to taxation. It would be a tragedy if oil companies were driven out of the North Sea and significant resources left in the ground just because governments felt the need to be seen to be squeezing tax from 'Big Oil'.

Chris Skrebowski

Web World

Many companies are still not exploiting the full potential of the Internet. There is a mistaken belief that the Web is only used by large corporations as a marketing tool. However, it provides the opportunity to reach all kinds of people – clients, potential clients, suppliers, employees and prospective employees.

You can make your product or service information available 24 hours a day, anywhere in the world. Everyone connected to the Internet can access your company, not just those people on your mailing list. Anyone requiring more details can e-mail you immediately, thereby avoiding postal delays and the poor quality of faxes. Their details are then presented to you in electronic format for future use. It is also possible to count the number of visitors to your site and log their e-mail addresses for mailings. Perhaps most importantly, information can be continuously updated without incurring printing and postage costs.

People are depending more and more on the Internet as a source of information, so now is the time to reserve your place in cyberspace. Setting up a web site is gradually becoming easier. Many Internet Service Providers (ISPs) include a certain amount of webspace with their e-mail and Internet access packages. However, you should be careful as some do not allow business use. You then need to decide whether to build the site yourself, either by learning the languages of the Web such as HTML and JavaScript, or by investing in a package such as FrontPage that will guide you through the process. Alternatively, you could hire a web design company or consultant to do the work for you.

One of the many benefits of IP corporate membership is a hot-link from our site (**www.petroleum.co.uk**), which receives 30,000 hits per month. This ensures that you will be reaching a wide range of industry professionals.

If you have any questions regarding the IP web site, or the Internet in general, please contact Catherine Pope, IP Webmaster, via e-mail on **cpope@petroleum.co.uk** or telephone +44 (0)171 467 7112.

This month's issue includes a look at recent North Sea developments. The following sites contain useful information relating to this sector: Offshore Technology (**www.offshore-technology.com**) offers sections covering projects, developments, companies, exhibitions and conferences. Oil Link (**www.oillink.com**) provides the latest oil and gas news, plus up-to-date prices from the *Wall Street Journal*. Finally, Offshore Northern Sea (**www.ons.no**) provides coverage of this annual conference. You can find these and many more links on the IP web site (**www.petroleum.co.uk**).

Insights from the statistics

In addition to being one of the most dynamic and fascinating oil and gas provinces, the North Sea is now well documented, especially the Norwegian sector. This allows analysis that otherwise would only be possible with confidential company data.

North Sea field developments have had few restrictions placed on them in terms of the way in which they are produced. High front-end costs mean the companies have had a strong economic incentive to maximise production (and income) as early as possible. The production profiles are largely economically defined and reflect what an oil company would do given a free choice. The 'dream' production profile for an oil industry manager would probably be very close to the profile planned for the Terra Nova field offshore Canada (see p34). In this the field starts producing at plateau, maintains this for a number of years and then rapidly declines to abandonment.

North Sea field production profiles generally fall into two groups: the 'cheese wedge' with a rapid production buildup, a limited plateau and then a long slow decline; and the more traditional 'ridge' with a slower production buildup and a more sustained plateau before the inevitable decline. Forties would fall into the first category, Brent and Magnus into the second.

The table lists and charts the volumes of oil produced in the peak year and the three peak years and relates them to the reported reserves of the fields. Although there is a range from relatively low peak recoveries, such as Beryl at 2.7%, most group around the 10% mark. A few anomalously high recoveries pose the question as to whether these fields are particularly productive or whether their reserves are understated.

It is usually said that peak flow correlates with gravity of the oil and the permeability of the reservoir. The North Sea fields examined show no clear pattern in terms of gravity but the range is relatively narrow, from 30° to 40°. The Jurassic fields in the North Sea are productive and support high flow rates. The figures confirm this and also show the way the more difficult chalk formations at Ekofisk and Valhall are unable to achieve the high flow rates of the Jurassic. The low peak flow at Beryl reflects a complex multi-horizon reservoir. The figures from the North Sea show that for a typical productive field around 10% of the reserves can be produced in the peak year. This would seem to imply that an additional 1mn b/d (365mn b/y) of peak production would require the discovery and development of 3.6bn barrels of new reserves.

The relationship offers an insight that can be applied to other parts of the world. For example, if unconstrained North Sea fields produce around 10% in the peak year and 25% in the peak three years, do we conclude recent Angolan discoveries, of up to 6bn barrels, will potentially support peak production of 600mn b/y or 1.64mn b/d?

According to the latest Petroconsultants statistics published in a recent promotion for its *World Petroleum Trends*, new field discovery outside the US has averaged 6.29bn b/y over the last five years. The North Sea data suggests this could support peak flow rates of 1mn to 1.75mn b/d.

	Field name	Reserves (mn)	Peak production (in 3 peak years)			Peak prdtn (years)	% of reserves produced (peak yr)	% of reserves produced (peak 3 yrs)	API degrees	Production formation
1	Statfjord	3,900	703	716	709	7 to 9	6.70	19.92	38–41	Mid & L Jurassic
2	Ekofisk+NGLs	3,066	336	402	469	9 to 10	5.58	14.37	36	Palaeocene &UC**
3	Ekofisk*	3,044	336	383	427	8 to 10	5.12	13.74	36	Palaeocene &UC**
4	Forties	2,500	503	503	505	4 to 6	7.37	22.06	37	Palaeocene
5	Brent	2,000	411	409	401	9 to 11	7.50	22.28	38	Mid & L Jurassic
6	Oseberg	1,950	501	592	499	7 to 9	11.08	29.80	33	Mid Jurassic
7	Gullfaks	1,786	494	522	563	7 to 9	11.51	32.27	29	Mid Jurassic
8	Beryl	1,530	96	111	97	4 to 6	2.65	7.25	36	Jurassic, Triassic
9	Ninian	1,178	294	304	281	4 to 6	9.42	27.24	35	Mid Jurassic
10	Piper	1,016	251	272	214	3 to 5	9.77	26.48	40	Upper Jurassic
11	Magnus	797	141	141	144	10 to 12	6.59	19.51	39	Upper Jurassic
12	Valhall	633	73	72	65	8 to 10	4.21	12.11	35	Upper Cretaceous
13	Claymore	578	97	96	103	6 to 8	6.50	18.69	30	Jurassic, Cretaceous
14	Fulmar	569	154	148	148	5 to 7	9.88	28.87	40	Upper Jurassic
15	Brae	565	134	122	129	6 to 8	8.66	24.87	33–49	Upper Jurassic
16	Ula	435	117	126	127	6 to 8	10.66	31.05	38.8	Upper Jurassic
17	Cormorant	430	90	103	103	3 to 5	8.74	25.13	37	Mid Jurassic
18	Thistle	415	109	113	122	3 to 5	9.59	30.26	38.5	Mid Jurassic
19	Dunlin	413	116	106	97	2 to 4	10.25	28.19	36	Mid Jurassic
20	Murchison	346	107	110	108	3 to 5	11.60	34.28	37	Mid Jurassic
21	Cormorant S	219	41	45	39	7 to 9	7.50	20.83	35–36	Mid Jurassic
22	Hutton	190	78	62	64	3 to 5	14.98	39.19	31	Mid Jurassic
23	Auk	118	25	48	27	1 to 3	14.85	30.93	38	Zechstein
24	Hutton NW	116	49	45	47	2 to 4	15.42	44.37	37	Mid Jurassic
25	Buchan	110	28	33	23	2 to 4	10.95	27.87	33.5	Devonian
26	Tartan	106	25	21	33	5 to 7	11.36	27.20	38	Upper Jurassic
27	Heather	105	25	34	27	4 to 6	11.82	29.90	34	Mid Jurassic
28	Montrose	96	25	28	25	3 to 5	10.65	29.66	40	Paleocene
						Average	**9.32**	**25.65**		

Sources: Official government figures with interpretation by Petroleum Review. ** Oil reserves excluding NGLs. ** UC: Upper Cretaceous*

Relationship between peak production and reserves in post-peak North Sea fields

UK signs hat-trick of Azeri PSA deals

Azeri President Haydar Aliyev signed three oil project agreements with UK companies during his four-day visit to the UK in July. The deals are part of an ongoing programme by Azerbaijan to boost production by attracting foreign investors. It is understood that the country plans a six-fold increase in output to over 1mn b/d by 2005.

A BP/Statoil alliance has agreed terms to develop the deepwater Sharg/Alov/Araz field in the Caspian Sea Abikh block which is estimated to contain 4bn barrels of recoverable reserves. Each company holds a 15% stake in the project, state owned oil company Socar holding a further 40%. The remaining equity is to be distributed at a later date.

UK independent Lasmo is a potential project partner. The company has been in Azerbaijan since early 1997. In an initiative to pursue deepwater initiatives in the Caspian it has formed an equal partnership with Braspetro, the international subsidiary of Brazilian state oil company Petrobras, a world leader in deepwater technology. Chris Wright, Lasmo's Director of New Business, told *Petroleum Review* that: 'the Lasmo–Braspetro partnership has requested a 10% to 20% interest in the Alov PSA'. Lasmo has also been working closely with the Institute of Geology at the Academy of Sciences in Baku, with whom several joint scientific investigations have been conducted.

BP and Statoil are to invest $75mn each in the exploration phase of the project, which includes the drilling of three wells by 2001. A further five exploration wells will be drilled by 2004. According to BP, prospective reservoirs are likely to be found between 2,500 metres and 6,500 metres below the seabed in 300 metres to 800 metres of water.

It is interesting to note that the BP/Statoil contract area is the largest granted in the Azeri sector of the Caspian Sea – reflecting the size of the geological structures contained within its boundaries. No wells have been drilled in the area which is likely to be a mixed oil play with associated gas. There are no resource or reserve estimates at this stage.

The Sharg/Alov/Araz project is the third major BP project in Azerbaijan, following the recent success in production of over 70,000 b/d from the AIOC-operated Chirag/Azeri development where output is expected to reach 100,000 b/d by year-end. (BP is a partner in the 12-company AIOC consortium.) The BP/Statoil alliance is also involved, acting as operator, in Shah Deniz where drilling began in July 1998.

The exploration, development and production sharing agreement signed with Monument Oil and Gas covers the offshore Inam block of the Azeri sector of the south Caspian Sea. Monument holds a 12.5% stake in the project. The remaining equity is held by a Socar affiliate (50%), Amoco (25%) and Central Fuel Caspian Sea (12.5%).

The agreement commits the foreign partners to acquire 3D seismic over the 225 sq km block and drill at least two wells during the initial three-year exploration period which may be extended for a further two years. If exploration is successful, the agreement calls for a 25-year development and production period which may be extended for a further five years.

Inam lies 30 km offshore in water depths ranging from 30 metres to 300 metres. Recoverable reserves are put at in excess of 1.4bn barrels of oil.

Ramco Energy signed a production sharing agreement for the rehabilitation, exploration and development of the Muradhanli/Jafarli/Zardab field onshore Azerbaijan. Claimed to be the country's largest onshore field, in-place reserves are estimated to be at least 5bn barrels of oil. The agreement also covers additional exploration within the 565 sq km area.

Steve Bertram, Financial Director of Ramco told *Petroleum Review*: 'Expenditure will be about $30mn in the first two years and the phasing in of development will depend on the results of early work.'

Ramco holds a 50% stake in the project, state owned Socar holding the remaining share. There are plans to introduce an additional partner in due course. According to Bertram, Ramco has every intention of remaining the operator with the possible minority partner offered a stake of between 5% and 10%. Work will commence immediately with the preparation of a rehabilitation programme which is expected to produce new incremental oil by mid-1999. Seismic and exploration drilling will begin later in 1999.

The Muradhanli field, discovered in 1969, lies 110 km southwest of Baku. It is situated adjacent to the AIOC western pipeline route which is due to become operational in early 1999. The field is also connected to the railway that links Baku to Poti and Batumi on the Georgian Black Sea coast – this rail link is currently being used by Chevron to export part of its Tengiz production from Kazakhstan, and to transport production from Turkmenistan.

In Brief

United Kingdom

Shell is understood to be selling its *49% stake in the central North Sea Kingfisher field which came onstream in October last year.*

Halliburton is understood to have *pulled out of a deal to acquire Amoco's 25.77% stake in the North West Hutton oil field in the North Sea.*

A group of North Sea operators with *interests in the South Halibut Basin have established a consultative forum to examine whether any joint development possibilities exist for the various oil and gas accumulations found in the area to date. Discoveries include Blake, Cromarty, Goldeneye, Hannay and the 14/26a gas find.*

The Conoco/Chevron operated Britannia *gas condensate field in the North Sea has come onstream on time and 20% under the original £1.65bn budget* *(see p18).*

European ministers at the Oslo Paris *(Ospar) Commission meeting in Portugal in July banned the dumping of steel oil platforms and reduced radioactive emissions to sea to 'near zero' levels. Under the proposals, all topsides will be brought to shore for recycling or final disposal. The footings of installations weighing in excess of 10,000 tonnes may be allowed to remain offshore.*

Europe

Gas and condensate output from *Statoil's Tommeliten Gamma field in the Norwegian North Sea has ceased following the shut down of Phillips Petroleum's Edda platform*

North America

The Petroleum Directorate of Nova *Scotia is reported to have introduced a new royalty regime which will guarantee the government between 48% and 67% of net cash flow from future offshore oil and gas discoveries.*

Jebco Seismic (UK) has announced that *the final migrated data from its recent 3,000 km survey of the North Flemish Pass Basin, offshore the East coast of Canada, is now available for review and supply. Five blocks in this relatively unexplored deepwater basin were posted for licensing earlier this year.*

NEWS Upstream

Multi-field ETAP project in production

The £1.6bn ETAP project in the central North Sea has delivered first oil two months ahead of schedule. The ETAP development includes seven oil and gas accumulations, of which four (Marnock, Mungo, Monan and Machar) are operated by BP and three (Heron, Egret and Skua) by Shell. Production facilities are based on a central processing facility (CPF), operated by BP, located over the Marnock field.

The Mungo field is being developed by a normally unattended installation, while Monan, Machar, Heron, Egret and Skua are all subsea developments tied back to the CPF. Oil is exported through the Forties pipeline system while gas will be exported via the Central Area Transmission System (CATS).

The Mungo field flowed first oil on 18 July with production reaching the initial target rate of 30,000 b/d a few weeks later. The remaining fields will be brought onstream over the next two months with production expected to build up to peak levels of 210,000 b/d of oil and 360mn cf/d of gas during 1999. This represents an additional 270,000 boe/d of UKCS production.

Partners in ETAP are BP, Agip UK, Esso, Mitsubishi Oil, Murphy, Shell and TOTAL. The fields are being developed by an alliance of contractors with two main groupings. Participants in the facilities alliance are Amec, BP, Barmac, Brown & Root, Consafe, EMC/Coflexip Stena, Heerema and Kvaerner. Participants in the wells alliance are BP, Camco, Cooper, Noble, Santa Fe and Schlumberger. Both alliances operate on a risk/reward basis and offer the contractors the potential to increase their profit margins should ETAP better its cost, schedule and production targets.

Total reserves from the seven high temperature/high pressure fields are estimated at 1.2tn cf of gas and 513mn barrels of liquids.

African deals agreed

Energy Africa has signed a production sharing agreement with the Government of Gabon under which it has taken a 40% stake in the Kari onshore permit. Kari adjoins the Ofoubou Ankania and Nziembou permits in which Energy Africa also has interests. The company has also signed a farmout agreement with Amerada Hess. Subject to government consent, it will acquire a 35% interest in the Azobe Marin exploration permit which lies to the northwest of Port Gentil. Some 35% of the 1,737 sq km area is offshore, the remainder in shallow water.

In a third deal, Energy Africa has acquired the International Finance Corporation's oil interests in their joint venture company Energy Africa Haute Mer Holdings Ltd in exchange for 5% of Energy Africa's issued share capital.

Woodside and Shell strike up alliance

Woodside Petroleum and Shell in Australia are reported to have announced plans to form an alliance.

Woodside will act as operator of Shell's upstream exploration and production operations in Australia, and will continue to operate the North West Shelf and Laminaria projects, while Shell is to provide technical support for Woodside's exploration ventures around the world.

Shell is Woodside Petroleum's biggest shareholder, holding 34.27% stake in the Australian company.

It has also been reported that there is a possibility that the alliance will extend to the two companies' Asian operations in the future.

Schiehallion field comes onstream

The Schiehallion field in the deep waters of the Atlantic Margin has entered production at an initial rate of 30,000 b/d. The £1bn development project centres on 29 seabed wells in four drilling centres, with oil production via a 900,000 barrel capacity FPSO. Oil will be offloaded into a dedicated shuttle tanker, the *Loch Rannoch*, every five to six days once peak production of 154,000 b/d is reached, and transported to the Sullom Voe oil terminal in Shetland where it will be stored in dedicated tanks.

Gas from the reservoir is to be reinjected into a separate structure in a bid to reduce emissions. In addition, volatile organic compound emissions will be reduced through the use of a displaced gas recycling system when transferring oil to the shuttle tanker.

Schiehallion lies in 375 metres water depth in UK blocks 204/20, 204/25a, 204/25b, 205/16 and 205/21b. Field partners are: BP (operator, 33.35%), Shell (35%), Amerada Hess (15.699%), Statoil (5.877%), Murphy Petroleum (5.877%) and OMV (5.877%). Some 340mn barrels of oil are expected to be produced from Schiehallion, with a further 85mn barrels from the Loyal satellite field which lies in block 204/20. BP and Shell are 50:50 partners in Loyal.

In Brief

***Amoco is reported to have drilled a** well in west-central Alberta which is producing over 70mn cf/d. It is claimed to be the second-biggest producing gas well drilled in Canada to date. In-place reserves are estimated to be 1.1tn cf of gas.*

Middle East

***Gulfstream Resources Canada reports** that the second phase of development of the Al-Rayyan oil field has been approved by the Qatar General Petroleum Corporation and is awaiting government ratification. A 400-km seismic programme is due to commence later this month with drilling planned for 1999.*

Russia & Central Asia

***A Rosneft subsidiary is reported to** have begun producing oil from the Odoptu field, northwest of Sakhalin Island. Average daily output is put at 14,000 barrels. Reserves are claimed to be 11mn tonnes, of which 3mn tonnes are recoverable.*

***Europa Oil & Gas has concluded an** agreement with Zahidukrgeologia and the Ukrainian State Committee of Geology to jointly develop resources in the Veliki-Mosty and North Yavorivska gas accumulations in western Ukraine. First commercial production is planned in 1999 with peak production anticipated to be up to 500mn cm/y of gas.*

***It is understood that Rosneft and its** subsidiary Sakhalinmorneftegaz are to each receive a 16.6% interest in a block in the Sakhalin 3 exploration project. Mobil and Texaco will share the remaining percentage equally.*

Asia-Pacific

***Arco and BG plc have announced that** proved gas reserves for the Tangguh project in Indonesia have more than doubled from the 6.3tn cf announced last year to 14.4tn cf as of 31 July 1998. Proved and probable reserves have also increased from last year's 13.3tn cf to 18.3tn cf this year.*

***Shell is reported to have awarded Allseas** Maritime Contractors a $500mn contract to lay a 506-km pipeline linking the Malampaya natural gas field offshore southwest Philippines to the northern mainland of Luzon. The contract includes the installation of two other lines.*

Value of UK oil production reaches all-time low

The real value of UK oil production in June 1998 reached its lowest level ever since the Royal Bank of Scotland first published its *Oil and Gas Index* in January 1983.

Prices are not expected to rise in the next few months, save for the possibility of renewed hostilities in Iraq. The company also states that while Opec has made some progress towards implementing the cuts agreed in June, further reductions in output are needed if prices are to rise.

The low oil price and seasonal dip in production also kept oil revenues low – at £17.17mn/d they were at their lowest in cash terms since June 1991. Even if the seasonal effect on volumes is removed, the 12-month average revenue figure in June – £25mn/d – was also the lowest in real terms for over four years, states the Royal Bank of Scotland.

However, a more encouraging finding is that the apparent upward trend in oil production reported last month is now more firmly entrenched. The 12-month moving average level of daily output increased for the fourth successive month.

Year Month	Oil production (av. b/d)	Gas production (av. mn cf/d)	Av. oil price ($/b)
May 1997	2,285,537	7,093	19.25
Jun 1997	2,156,115	6,515	17.70
Jul 1997	2,458,846	6,018	18.41
Aug 1997	2,428,302	5,883	18.38
Sep 1997	2,526,529	6,376	18.49
Oct 1997	2,619,632	8,249	19.89
Nov 1997	2,553,987	10,075	19.07
Dec 1997	2,709,258	10,950	17.38
Jan 1998	2,598,757	11,081	15.20
Feb 1998	2,582,700	10,355	14.07
Mar 1998	2,595,594	9,841	13.17
Apr 1998	2,571,241	9,233	13.53
May 1998	2,433,059	6,412	14.40
Jun 1998	2,406,521	6,085	12.12

Source: The Royal Bank of Scotland Oil and Gas Index

North Sea oil and gas production

Russian PSA legislation

Production sharing agreement (PSA) legislation has been passed by the Russian Duma, according to the United Financial Group's *Russia Morning Comment*. However, the bill has yet to be passed by the Federation Council and signed by President Yeltsin, neither of which is a certainty.

A number of restrictions are included in the new bill, including a 20% threshold on the level of Russian reserves that can be developed under PSA terms and a requirement that 70% of equipment should be sourced from within Russia. The Duma also proposes to approve each project individually. However, United Financial Group suggests this will prove unacceptable to the government which is likely to want to retain more freedom to reach PSAs without excessive political wrangling.

The bill does not apply to projects that are currently under development, or to the seven projects on the first Duma list, the two Sakhalin projects and one other development.

Uzbekistan funding

Uzbekistan is seeking foreign investment for six new projects in the poorly explored and developed Ustyurt region. The six blocks are located structurally along strike from the Zheybai, Uzen and Kalamkas fields in the Buzachi and Mangyshlak regions of Kazakhstan (each estimated to contain over 200mn tonnes of oil).The Aral Sea block also includes a structural continuation of the Zaunguz-Murgab Graben along which the 60tn cf Dauletabad gas field is located.

Four of the blocks include existing hydrocarbon fields – mostly gas but with some oil present. The largest field, Urga, has estimated in place resources of 47mn cm of gas. All the blocks have pipelines connecting them to the Gazprom grid and there are proposals to construct further links to China, Afghanistan/Pakistan and Azerbaijan. Foreign companies are invited to participate in these new projects by forming a joint venture with Uzbekneftegaz, signing a production sharing agreement or by taking a concession entirely in their own right.

In Brief

Integrated geoscience consultancy *Scott Pickford has commenced an interpreted lithology project covering the Bonaparte Basin in the Timor Sea area of the Australian North West Shelf. Sponsored by BHP Petroleum, Shell and Woodside Offshore Petroleum, the Australia North West Shelf Interpreted Lithology Project (ANWIL) will provide an interpretative dataset for companies wishing to study, correlate between and review reservoir geometry encountered in wells over the Timor Sea region using workstation applications.*

Chevron has acquired a 20% interest *in deepwater permit W97-16 in the Browse Basin offshore northwest Australia. The company already holds a 16.7% stake in the Scott Reef and Brecknock gas fields in the adjacent WA-33-P permit which are estimated to hold more than 20tn cf of natural gas.*

Unocal and Mobil are reported to have *discovered a new oil field in the deep waters of the Kutei Basin offshore East Kalimantan in Indonesia. The West Seno No 2 well tested at 2,900 b/d of oil and 3.1mn cf/d of gas.*

Brown and Root has signed two contracts *worth $400mn for the design, procurement, fabrication, installation and commissioning of the Malampaya offshore platform in the Philippines.*

Sabah Shell Petroleum Company *(SSPC) reports that it is to drill Malaysia's first deepwater exploration well in its block G acreage, 100 km offshore Kota Kinabalu, in October 1998.*

It is understood that production from *Thailand's Pailin field will be delayed by up to nine months until June or September 1999 following delays in laying of the 53-km pipeline linking the field to PTT's Gulf of Thailand gas grid and a drop in demand for natural gas. Potential reserves are estimated to be 2tn cf of gas.*

Arco has stated that it will not renew *its remaining exploration lease for block M-9 offshore Myanmar upon the anniversary date of the lease in October 1998.*

It is understood that production from *Indonesia's Natuna gas field project will be delayed by up to three years because of lower than anticipated demand for gas in Asia. The project is now expected onstream no earlier than 2007.*

UPSTREAM News in Brief cont'd on p11

NEWS Downstream

Drive towards pan-European fuel cards

The increasing importance and ease of inter-European trade, together with the high level of cost savings possible, means that fuel cards are becoming increasingly popular tools for fleet managers, according to a new report from MarketLine International. The company also predicts that with the 'strong possibility of further alliances between service station networks in the EU' and new companies introducing the option of pan-European cards in the near future, the number and penetration of fuel cards is 'set to rocket'.

The report states that there are currently 14mn fuel cards in circulation in the EU, accounting for 31% of all fuel purchases – a figure predicted to increase to over 40% by 2005. Almost half of the fuel cards in circulation in 2005 are expected to be pan-European.

Fuel cards offer the issuer a new dimension in the acquisition of consumers across the EU by tying business and non-business users to one or more petrol retailers, while providing the fleet manager cost savings on fleet administration and improved fleet management efficiencies.

In 1997, Sweden had the largest number of fuel cards in circulation in the EU, with approximately 3.9mn cards, equivalent to 28% of the EU total. The UK had the second largest circulation, with 2.3mn fuel cards or 16.5%, followed by Germany with 2mn cards. In terms of fuel volumes purchased on fuel cards, Denmark had the highest penetration rate in the EU with 60% of fuels sales purchased on fuel cards, followed by Sweden and Spain with 55% and 45%, respectively. In contrast, Greece and Austria had the lowest penetration levels with 10% and 17%, respectively.

According to the report, many companies are considering expanding their fuel card operations into Spain, Greece and Turkey with the aim of eventually spreading their operations into North Africa, particularly Morocco, and the Middle East. Germany is also a target for companies wishing to expand fuel card networks into the central and eastern European market – a region experiencing a period of rapid fuel consumption and increase in car parc. Demand for pan-European cards is predicted to grow at an average annual rate of 5.5% to 2005 compared with average growth of 1.8%/y for national cards over the same period, driven by the substantial increase in cross-border traffic within the EU. Greece, Luxembourg and Spain are expected to have the fastest growth in pan-European fuel cards, with mature markets such as Belgium and Denmark being less dynamic.

UK fuel prices in July

	Pence per litre
Diesel	
Lowest: Bradford	65.06
Highest: Inverness	69.89
National average	67.26
Unleaded petrol	
Lowest: Bradford	64.69
Highest: Dover	68.57
National average	66.46
Four-star petrol	
Lowest: Halifax	69.14
Highest: Inverness	75.25
National average	72.23

Source: *PHH Allstar Fuel Report*

Upbeat results

Van Ommeren has reported a 21% improvement in half-year profits on ordinary activities after taxation to Fls77mn. Ship sales accounted for Fls6mn of the total.

The company also reported that tank storage showed a strong improvement, rising 67% to Fls85.4mn. Continuing demand, particularly for petroleum product storage, ensured high capacity utilisation in all regions which, in turn, drove rate increases, stated the company. 'The current petroleum product contango (rising forward prices) is expected to continue for the time being, with customers seeking additional tank storage capacity, which is rare'.

However, tanker shipping profits declined from Fls37.4mn in 1H1997 to Fls19.3mn largely due to the deconsolidation of Van Ommeren's shipping interests to Brostom Van Ommeren, in which Van Ommeren has a 50% stake. The company expects 'continued weakness in the tanker shipping market', with ocean shipping affected by the Asia-Pacific economic crisis and the inland business by growing competition in gas shipping.

In Brief

United Kingdom

Falmouth Oil Services has secured *a contract for the disposal of oil and water wastes from HM Dockyard at Portsmouth. A 400-tonne barge, fed by main contractor Serco Denholm's own lighters, will carry the waste by sea to the fully licensed Great Marsh transfer station at Eling terminal. Alternatively, the load may be transferred to a sea-going tanker for direct transmission to Falmouth.*

Electricity regulator Offer has *announced that competition in the UK electricity market is to start on 14 September 1998 in Hull, Norwich, Chester and Motherwell. Deregulation is to be rolled out nationwide in a phased programme similar to that used to open the UK domestic gas market to competition. More than 300,000 customers are reported to have signed up to buy their electricity from British Gas.*

UK gas industry watchdog Ofgas has *begun an investigation into reports that some gas suppliers have been stopping industrial and commercial customers from changing to another supplier.*

Shell UK has opened the first motorway *service station on the North Cheshire M56. The £7mn site was designed and built by David McLean Contractors as part of a three-year 'partnering' agreement with the oil group.*

Simon Storage's Seal Sands terminal on *Teesside has received a five star safety rating for it hazardous goods storage operation from the British Safety Council.*

Europe

Mol has acquired a 35.45% stake in *Hungarian regional gas distributor Egaz. Located in northwest Hungary, Egaz is majority owned by Gaz de France.*

Slovnaft is reported to have *announced plans to expand its 31-strong network of service stations in the Czech Republic by another 45 sites.*

BHP Petroleum is reported to be planning *to begin building a $250mn, 60,000 b/d oil production facility in Algeria in 1999.*

NEWS Downstream

Scottish fuels distribution first for TDG

Scottish independent fuels retailer Spartan Petrol has awarded TDG McPherson a contract to deliver up to 1mn litres of fuel per week to its Scottish service station network. The TDG Group's Scottish subsidiary, traditionally a logistics supplier in the whiskey and associated industries, is expanding operations to cover fuel distribution – Spartan Petrol is one of its first clients in this arena.

A dedicated fleet of Hockney Thomas (Tank Having Optimum Mass and Stability) tankers will collect gasoline and diesel from terminals at Leith, Grangemouth and Clydebank and deliver to Spartan Petrol's sites across Scotland.

Engen focuses on African market

Engen has concluded two deals in a drive to expand its African market. The first involves a marketing, sales, distribution and storage joint venture in the Democratic Republic of Congo (DRC) with PetroFina. Assets include a twin pipeline stretching over 350 km from Ango-Ango to Kinshasa. The joint venture will have approximately 30% market share in the DRC. PetroFina will retain operatorship of the business and products will be co-branded.

The South African oil company has also acquired the marketing and distribution activities of PetroFina and BP in Rwanda and Burundi, who have worked as partners in the two countries' for a number of years. Engen will assume both operatorship and management of the two companies operations and is to re-image the networks with Engen branding.

In Brief

North America

Gas-to-liquids specialist Syntroleum *Corporation has completed a merger with SLH Corporation which, prior to the merger, owned 31% of the outstanding common shares of Syntroleum.*

Tejas Natural Gas Liquids and *Marathon are reported to have announced plans to construct a cryogenic natural gas processing plant near Centerville, Los Angeles, to handle gas production from the Gulf of Mexico. The facility is due onstream in 1Q2000.*

Arco is understood to be planning to *join Foothills Pipe Lines of Canada, Japanese trading house Marubeni, Phillips Petroleum and CSX Corporation in a four-year, $100mn project to market LNG to East Asia. The project would involve the construction of an 800-km pipeline linking Alaska's north rim to its shipping port in the south, from where LNG would be shipped to Asia.*

Russia & Central Asia

Kazakhstan is reported to have cut *daily processing at its Pavlodar oil refinery from 17,500 tonnes to 7,000 tonnes due to a 'lack of tankage'.*

Gazprom is understood to have *agreed to increase volumes of gas supplied to Armenia over the period 1998–2000. The Russian gas company currently supplies 1.5bn cm/y to Armenia.*

DOWNSTREAM News in Brief cont'd on p12

UK Deliveries into Consumption (tonnes)

Products	†Jun 1997	*Jun 1998	†Jan–Jun 1997	*Jan–Jun 1998	% Change
Naphtha/LDF	177,224	247,417	906,921	1,476,543	63
ATF – Kerosene	757,261	803,407	3,940,035	4,202,010	7
Petrol	1,922,165	1,842,748	11,096,437	10,688,182	–4
of which unleaded	1,372,088	1,444,534	7,823,453	8,229,933	5
of which Super unleaded	46,396	32,380	270,991	206,356	–24
Premium unleaded	1,325,692	1,412,154	7,552,462	8,023,577	6
Burning Oil	161,840	211,405	1,752,398	1,824,943	4
Derv Fuel	1,321,300	1,302,358	7,426,159	7,432,899	0
Gas/Diesel Oil	516,426	541,101	3,744,042	3,576,819	–4
Fuel Oil	274,188	192,341	2,328,093	1,460,664	–37
Lubricating Oil	74,174	70,126	442,059	421,140	–5
Other Products	687,720	687,207	4,193,740	4,106,333	–2
Total above	5,892,298	5,898,110	35,829,884	35,189,533	–2
Refinery Consumption	515,053	561,905	3,195,746	3,244,946	2
Total all products	6,407,351	6,460,015	39,025,630	38,434,479	–2

† Revised with adjustments *preliminary

NEWS Industry News In Brief

BP and Amoco merge global businesses

BP and Amoco unveiled plans to merge their global energy and petrochemicals operations last month. The combined enterprise, said to be the largest ever industrial merger, will be called BP Amoco and is expected to result in some 6,000 job losses out of a total workforce of around 100,000. Combined current market capitalisation is estimated to be $110bn, placing the united group among the top three oil and gas companies in the world, along with Shell and Exxon.

The move is expected to deliver synergies from cost savings that are predicted to add at least $2bn pre-tax a year by end-2000 to the earnings already separately targeted by the two companies.

The merger will be effected by the issue of new BP shares, in the form of American Depository Receipts, in exchange for Amoco common stock, with BP shareholders owning 60% and Amoco shareholders owning 40% of the combined group.

The board of BP Amoco will comprise 13 directors from BP, of whom six will be executive directors, and nine directors from Amoco, of whom two will be executive directors (see p48). BP Chief Executive Sir John Browne will be CEO of BP Amoco. He will also act as Chairman of the Management Committee, with Amoco Chairman Larry Fuller acting as Deputy Chairman. The two will co-chair the transition team responsible for integrating the operations of the new group. BP Deputy CEO Rodney Chase and Amoco President Bill Lowrie will be Deputy CEOs and Presidents of BP Amoco. Chase will have responsibility for exploration and production and Lowrie for refining and marketing, and chemicals.

The worldwide headquarters of the BP Amoco group will be in London, while Amoco's head office in Chicago will act as headquarters for the group's North American refining, marketing and transportation business and, in due course, the worldwide chemicals business. Exploration and production operations for the western hemisphere will be managed from Houston, Texas, where both BP and Amoco currently have offices. The Amoco brand will be extended over time to all BP's retail gasoline and convenience store outlets in the US. Retail sites elsewhere in the world will continue to carry the BP brand.

The group will have combined reserves of around 14.8bn barrels of oil and gas equivalent and daily production of around 3mn barrels. With prime positions established in major oil and gas provinces around the world, the new venture will be the largest producer of oil and gas in the US with output from Alaska, the Gulf of Mexico and the 48 states, as well as in the UK North Sea. Amoco is already the biggest gas producer in the US and Canada. Interest in new acreage is to focus on Algeria, Angola, Argentina, Australia, Azerbaijan, Bolivia, Canada, Colombia, Egypt, Kazakhstan, Kuwait, Norway, Oman, Russia and Siberia, Trinidad, the UAE and Venezuela.

Downstream assets include 17,900 BP and 9,300 Amoco service stations worldwide and 12 BP owned or part-owned refineries in 12 countries, including the UK, France, Spain, the US, Australia, South Africa and Singapore, and five Amoco refineries in the US. Combined oil product sales are put at 4.5mn b/d and refinery output around 2.8mn b/d. Amoco is one of the leading gasoline marketers in the US. Based on 1997 sales, the new group will share top place for retail sales east of the Rocky Mountains, with first or second position in some 20 states.

Combining the chemicals operations of BP and Amoco will create a business with revenues of $13bn that marries the strengths of BP in Europe and Amoco in the US to create what will be the world's third largest chemicals company.

The two companies have agreed $1bn compensation terms in the event that shareholders do not approve the deal, or if a better offer is made for Amoco, and the merger does not go ahead as planned.

In Salah development contract awarded

JGC/Kellogg, a joint venture between JGC Corporation of Yokohama in Japan and Houston-based M W Kellogg Company, has secured a contract for the front-end engineering design (FEED) of the BP/Sonatrach In Salah gas development in southern Algeria.

The $3.5bn In Salah project involves the development of a number of gas fields which lie between El Golea and In Salah, a distance of 350 km. A pipeline, road, airfield and accommodation infrastructure is to be developed together with gas processing facilities including carbon dioxide removal capabilities. The facilities are located in a remote desert area and the proposed 48-inch diameter export pipeline will stretch some 500 km to existing facilities at Hassi R'Mel. In Salah Gas is currently drilling nine exploration and appraisal wells. Drilling is scheduled to complete in 1Q1999, which will tie in with the FEED work and gas marketing to enable a development decision to be taken in 3Q1999.

United Kingdom

***It is understood that Alliance** Resources has delayed its proposed $34mn acquisition of Difco, which has a conditional agreement to acquire 20% of 13 blocks in Liverpool Bay and the east Irish Sea. The two companies are reported to have been unable to agree an acceptable form of financing the deal.*

***Shell has established a new organisation,** Shell Technology Ventures (STV), to spearhead the rapid development and deployment of the group's exploration and production technologies.*

***The UK Offshore Contractors'** Association (OCA) has set up a central database of welders listing their qualification details which can be accessed by member companies to ensure that they are current and up to date.*

Europe

***Aker is reported to have established a** new seismic business – Aker Geo – based in Oslo. The company recently acquired Norwegian geological and geophysical service company JSI, now renamed Aker Geo Petroleum Services.*

***Finland has announced plans to sell** between 20% and 25% of energy group Fortnum in September.*

Middle East

***The UN anticipates that Iraqi exports** will fall well short of the expected $4bn in the period 30 May to 25 November as the country has so far only sold $1.06bn worth. The shortfall largely reflects current low oil prices as the IEA statistics show that Iraq produced 1.86mn b/d in June and 2.2mn b/d in July. Under the UN oil-for-food plan, Iraq is allowed to export up to $5.2bn of oil every six months in exchange for food and medicine.*

***Saudi Arabia is understood to have** announced plans to cut its September contractual export liftings by 18% in a bid to raise oil prices.*

Russia & Central Asia

***It is understood that Russia has authorised** the sale of state-owned interests in foil companies Vostsibneftegaz, Eastern Oil, Sibur, Tyumen Oil, Komitek and Norsi-Oil through an auction process.*

Tackling distortions in UK electricity market

Margaret Beckett, President of the Board of Trade, has announced that the UK government is to sort out distortions in the electricity market as well as take steps to ensure diversity and security in electricity generation. It is hoped that such moves will create a more competitive electricity market in which all energy sources can compete on a level playing field, delivering lower electricity prices for consumers. In the meantime, the government also proposes to operate a stricter policy on consents for gas-fired power stations, Beckett stated.

Basic flaws in existing electricity market arrangements were identified by the government's review of energy sources for power generation:

- New gas entry into the market has been substantial but this has not significantly increased competition nor has it led to the expected falls in the price of electricity.
- The electricity pool, set up in 1990, ensures electricity is available to all whenever they need it but has led to distortions which have affected the choice of energy sources for power stations.
- The distortions have favoured gas plant which is operated inflexibly over flexible coal plant.
- These distortions have led to a building boom in gas-fired stations to the detriment of coal-fired ones.
- Electricity cannot be stored and thus needs to be produced on demand (hourly and daily requirements differ) – coal-fired capacity is currently providing the flexibility which gas stations are not.
- There are important technical issues which the independent consultants conducting the review (Merz and McLellan) believe should be addressed if there is further growth in gas-fired combined-cycle gas turbine generation.
- As a result of the distorted market, dependence on gas could rise sharply to reach over 75% of electricity generation by 2020 (much of it imported from outside the EU), raising concerns over diversity and security of supply.

It is hoped that wholesale electricity prices will fall by more than 10% once the distortions in the market have been eliminated. The agenda for electricity market reform includes:

- A reform of electricity pool trading arrangements.
- Addressing the technical issues raised by the review.
- Seeking opportunities for divestment of coal-fired plant by the major generators.
- Pressing ahead with the introduction of competition in electricity supply.
- Separate licensing of distribution and supply of electricity to ensure that monopoly and competitive activities are clear.
- Ensuring fair trading in electricity via the interconnector with France which is currently only being used one way to import electricity.

While many industry bodies and companies have voiced their support for a reform of the electricity market that will benefit both domestic and industrial consumers, both the Confederation of British Industry (CBI) and the UK Offshore Operators Association (UKOOA) have expressed concern over the continued artificial restrictions on gas-fired power in the interim. UKOOA Director-General James May said: 'The continued restrictions on gas-fired power stations will have a negative impact on investment and jobs in the gas industry, and will undermine confidence in the future viability and investment potential of gas in the UK'.

Arco and Mobil swap US assets

Arco's wholly owned subsidiary Western Midway Company has reached agreement with Mobil Exploration & Producing US Inc to exchange all its oil and gas producing properties and associated facilities in California's San Joaquin Valley for certain Mobil oil and gas assets in the Gulf of Mexico. In a separate deal, Arco and Houston-based Vastar Resources have agreed that, upon completion of the exchange with Mobil, Arco will sell Western Midway to Vastar for $470mn. Arco owns an 82.2% interest in Vastar which is a major player in the Gulf of Mexico.

Arco's California properties include five fields in Kern and Los Angeles counties and an interest in a cogeneration facility in the Midway–Sunset field in Kern county. Net production from the fields is 40,000 b/d of oil and 10mn cf/d of gas. Proved reserves total 160mn boe. The exchange does not include the operations of Arco Long Beach.

Mobil's properties include working interests in 23 producing fields and 93 platforms, as well as interests in over 80 lease blocks in the western and central Gulf of Mexico. Net proved reserves are 360mn cf of gas equivalent. Also included in the proposed exchange are interests in pipelines, gathering lines and a shorebase in Cameron, Louisiana.

The exchange will result in the closure of the Bakersfield, California, headquarters of Western Midway and will lead to a pre-tax loss in excess of $100mn for Arco, to be charged against earnings in 3Q1998.

In Brief

***The Russian Government is reported to** be planning to sell a 5.87% stake in Gazprom this year, bringing its interest in the oil and gas company to 35%. It is understood that the government hopes to raise some $1.8bn from the sale.*

Asia-Pacific

***Enterprise Oil is understood to be** closing its Vietnamese office.*

***Thai state owned company PTT is** reported to have announced total remaining proven hydrocarbon reserves at 30 June 1998 of 727.7mn boe, up 21% from six months ago. Probable and possible reserves declined by 2.4% to 672.5mn boe during the same period.*

Latin America

***Lasmo is to sell its Colombian subsidiary** to Braspetro Oil Services Company, the Petrobras subsidiary responsible for the company's E&P activities outside Brazil, in a deal worth $151mn. A total of 75% of the company will be transferred initially under the agreement, the remaining 25% deferred until April 1999, guaranteed and deductible against the possible acquisition of assets offshore Brazil.*

General

***Kvaerner has been placed in first position** out of 225 in the US Engineering News Record (ENR) worldwide engineering and construction rankings, which are based on revenue, scope of work and geographical spread, for the second year running. Earlier this year, it also achieved first place in ENR's top 200 international design firms ranking, which listed companies by international billings for design services performed in 1997 in $ millions.*

***US-based international information** database publishing group Information Handling Services has acquired MAI Consultants of London. MAI provides industry cost and operating data, along with analysis and modelling tools, which are used to assess oil and gas development planning, cost estimating and economic analysis.*

***Houston-based Maurer Engineering** has been awarded contracts valued at over $1mn for the supply of high-tech drilling and completion software, training and support services to China National Petroleum Company.*

Shell and Occidental agree major asset swap

Shell is to exchange its oil and gas holdings in Yemen and Colombia for Occidental's oil and gas interests in the Philippines and Malaysia.

Under the complex deal – said to be one of the largest cross-border exploration properties exchanges ever undertaken – Shell will receive 100% ownership of Occidental's upstream subsidiary in the Philippines, holding a 50% interest in the SC-38 concession offshore the Philippines which includes the Camago/Malampaya gas fields.

In addition, Shell will receive all the stock in Occidental Petroleum (Malaysia) Ltd (OPML) and 90% of the stock in Occidental LNG (Malaysia) Ltd (OLML). Occidental will also make a cash payment to Shell to balance the difference in the overall transaction value.

In exchange, Occidental will acquire the assets and businesses of Pecten Yemen Masila and the stock of Compania Shell de Colombia (CSC) Inc.

The agreement will increase Shell's oil and gas reserves by 60mn boe. It will also bring the company's shareholding in the SC-38 concession up to 100%.

The Camago/Malampaya gas-to-power project in SC-38 represents the first large-scale development of indigenous gas resources in the Philippines and is expected to reduce the Philippines' reliance on imported fuels by 20% to 30%.

OPML's subsidiary Occidental Oil and Gas (Malaysia) holds a 37.5% interest in the SK-8 block offshore Sarawak, Malaysia, which contains six gas discoveries with an estimated 3.8tn cf of gas together with scope for further exploration. SK-8 gas will be delivered to the Malaysia LNG Tiga joint venture in which OLML and Shell each hold a 10% interest.

Compania Shell de Colombia holds a 25% interest in the Cravo Norte association contract which contains the large Cano Limon field in Colombia. Field production has averaged 160,000 b/d to date and has claimed proven reserves of 220mn barrels.

The company also holds 37.5% and 50% stakes in the Samore and Soapga exploration contracts respectively. Occidental (operator) holds an 18.75% and 37.5% interest in Cravo Norte association contract and Samore contracts respectively.

Shell's wholly owned subsidiary Pecten Yemen Masila holds a 20% stake in the Masila block which contains 13 discovered fields. Proven reserves are put at 170mn barrels. Oil production from the block currently averages 200,000 b/d. Occidental already holds an 18% interest in the block while Occidental Offshore International (operator) holds a 52% stake.

Fair deal sought for UK utility customers

The objective of the UK Government's proposed changes to the regulatory frameworks for gas, electricity, telecommunications and water is 'a fair deal for all consumers from innovative and efficient businesses', stated the President of the UK Board of Trade, Margaret Beckett, in July.

The government intends to introduce legislation to set a long term stable regulatory framework for the next decade which is designed to ensure lower prices and high quality service for customers at home and in businesses. Key decisions include:

- the regulatory framework should be able to address structural change in the utility markets, including multi-utilities;
- electricity watchdog Offer and the gas industry regulator Ofgas should merge their operations;
- consumer protection should be the regulator's primary duty;
- independent consumer councils should promote consumer interests;
- the RPI-X should be retained as the fundamental system of price regulation in the utilities sector;
- however, regulators should consider the exceptional circumstances where it may be appropriate to refine RPI-X to reflect the government's Green Paper principles on price regulation;
- a clearer link should be made between the price utilities can charge and the customer service standards they achieve;
- full information should be made available on companies' performance on customer service standards and on the links between this performance and the remuneration of directors;
- Ministers should issue statutory guidance on social and environmental objectives; and
- the energy and telecommunications regulators should be replaced by executive boards.

UPSTREAM cont'd from p6

***Bangladesh is understood to have** awarded interests in five oil and gas exploration blocks in its second licensing round to Cairn Energy and Shell (block 5); Triton, Unocal and PTI Oil and Gas (block 7); Pangea Energy and OMV (block 8); and Enron Oil and Okland International (blocks 3 and 6).*

***Arco has completed its acquisition** from Triton of a 25% interest in a natural gas project in the Malaysia–Thailand Joint Development Area in the Gulf of Thailand. Gross resources are estimated to exceed 10tn cf equivalent of natural gas.*

***Hardy Oil & Gas has announced that** the Rose-1 exploration well in the Carnarvon Basin offshore Western Australia has tested at a combined rate of 89mn cf of gas and 3,100 barrels of condensate.*

***Tullow Oil has signed three production** sharing contracts in India covering blocks GK-OSJ-1 (Gujarat Kutch basin, offshore northwest India), KG-ON-1 (onshore in the Krishna Godavari basin, southeast India) and CR-ON-90-1 (onshore in the Arakan basin in Assam, northeast India).*

Latin America

***Emerald Energy has acquired a 25%** stake in the 720 sq km area adjoining its Matambo block in the Upper Magdalena Valley of Colombia from TOTAL.*

***Dallas-based Harken Energy Corporation** has announced that its exploration programme on the Bolivar contract area in the Middle Magdalena Valley of Colombia has more than tripled its Colombian proved reserves since 31 December 1997 to 32.48mn boe.*

***Mitsubishi Corporation and Itochu** Corporation are understood to be planning to set up an operating company by the end of 1998 to develop the Barracuda and Caratinga oil fields offshore Brazil. Combined field reserves are estimated to be 485mn barrels. First production is expected in 2001.*

Africa

***South African company Sasol is** reported to have discovered a commercially exploitable oil deposit off the coast of Gabon. An exploration well tested at 3,500 b/d.*

Low oil prices impact company results worldwide

Continued low oil prices and the Asian economic crisis have hit the international oil industry hard, with most companies reporting a downturn in profits in the 1H1998.

BP announced that an 8% increase in oil production in 1H1998 was more than offset by the continued low oil price which led to a 26% drop in replacement cost profit, before exceptional items, to £542mn.

Despite this, the company stated that the dividend rose by 9% to 6 pence per share – an increase made possible by a $150mn improvement in the company's underlying performance according to Chief Executive Sir John Browne. BP's return on capital employed was around 12% for the 2Q1998.

Operating profits from exploration and production fell to £447mn, compared with £695mn in 2Q1997. Refining and marketing operating profits in the period were £299mn, compared with £308mn a year earlier, although half-year profits rose by 11% to £533mn. Chemicals profits dropped to £101mn in 2Q1998 (£136mn, 2Q1997).

Announcing the financial figures, Browne said that he expected little improvement in oil prices until the 4Q1998 when the latest Opec production cuts should be making a greater impact in the market.

Average oil prices of $13.50/b are $6.40/b down on a year ago, he stated, the lowest in 25 years after discounting inflation.

Shell, too, announced a significant drop in profits – 2Q1998 net profits falling by 17% to $1.54bn. 1H1998 net profits were down 20% to $3.48bn. Oil production rose 4% in the second quarter of the year, but was not enough to offset the impact of continued low oil prices which drove exploration and production profits down by 46% to $507mn.

Profits were also significantly down in the chemicals sector which recorded a 28% reduction to $172mn. Return on capital employed fell to 10.2% from 11.8% a year earlier.

Shell Chairman Mark Moody Stuart said that he too expected the oil price to rise by the end of 1998 once Opec's latest production cuts take effect. However, he said that he did not expect the price to reach the company's earlier target of $36;15/b average for the year.

Ranger Oil announced an 8% decrease in total revenues in 1H1998 to $155.2mn – the significant decline in oil price claimed to have more than offset a 56% increase in daily oil production to 51,327 barrels.

Meanwhile Lasmo reported a 20% fall in first-half turnover to £290mn, a drop partially offset by an 11% increase in production.

Although Statoil announced a profit after tax of NKr1.5bn for 1H1998, against NKr2.7bn in the same period a year earlier, operating profit fell NKr3.9bn to NKr6.2bn. NKr2.4bn of this reduction was attributed to reduced oil prices.

In the US, Oryx Energy reported a 2Q1998 net income of £16mn, compared with net income of $23mn in the same period a year earlier.

However, the company stated that it expected second-half figures to improve as a result of production increases and improvements in unit costs.

Occidental Petroleum Corporation announced a net income of $186mn in the same period, down from $158mn in the 2Q1997, while Chevron revealed a 30% fall in second-quarter net income to $823mn.

Phillips Petroleum reported a 2Q1998 income of $158mn, down 49% from year-earlier figures.

Arco announced 2Q1998 earnings, excluding special items, of $220mn, down 44% compared to last year. The fall in earnings was attributed to low oil prices and lower production levels in the company's upstream sector.

However, new field start-ups in Alaska, the North Sea and the Gulf of Mexico, coupled with production from former Union Texas properties, are expected to result in a 5% production increase for 1998 as a whole.

Apache Corporation reported 2Q1998 net income of $9.2mn, down from $25.7mn in the prior-year period.

Hungarian oil and gas company Mol, however, posted half-year results that represented a sharp contrast to the general trend of declining profits reported by much of the industry.

Net income increased by a massive 132% to HUF29.1bn ($138.2mn) from HUF12.5bn in 1H1997, while operating cash flow rose 25% to HUF64.5bn ($306.4mn).

According to Mol, the impact of sharply lower crude oil and oil product prices were 'overshadowed by strong demand growth for key oil products in Hungary, improving refinery and marketing margins, as well as a marked improvement in the profitability of Mol's natural gas business'. Return on capital employed rose to 14% in the 1H1998.

In Brief

DOWNSTREAM cont'd from p8

Azerbaijan is understood to have *rejected an offer by BP and Statoil under which they proposed to take the lead in organising the financing and construction of an oil pipeline linking Baku in Azerbaijan to Ceyhan in Turkey. It is understood that the Azeri Government wants all 12 members of the AIOC consortium to take part in a main pipeline export route.*

Asia-Pacific

The Petroleum Authority of Thailand *PTT is reported to have announced plans to sell its stake in three Thai refineries, only retaining its share in Thai Oil, the most prosperous of the four plants in which it holds interests.*

Mobil Oil is reported to have signed *joint venture contracts with Jamuna Oil Company of Bangladesh under which a $25mn LPG import terminal and lubricant oil blending plant will be built in Chittagong.*

Shell Eastern Petroleum has achieved *certification to the ISO 14001 environmental management standard for its largest oil refinery located in Singapore.*

Philippine refiner Petron is reported to *be seeking strategic partners to construct a $1bn, 365-MW power generating plant.*

Latin America

TOTAL is understood to have acquired *a 10% stake in an Andean gas pipeline from Gasoducto GasAndes. The pipeline currently has a capacity of 9mn cm/d of gas, which is to be increased to 20mn cm/d in order to meet growth in demand from central Chile.*

Africa

TOTAL is reported to be planning to *strengthen its west African refining and distribution operations through the purchase of PetroFina's 36% stake in TOTAL Fina Gabon and the state-owned assets of Total Guinee Equatoriale in which it already holds an 80% interest.*

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FLOW COMPUTERS

DANIEL

North Sea keeps tight hold on technology

While the North Sea may be currently feeling the pinch of low oil prices, UK taxation threats and Norwegian overheating, it continues to generate new technology solutions, often acting as a test bed for the wider industry, reports *Terry Knott*.

Rockwater's fabrication site at Wick in Scotland

Downhole, subsea or on the surface, technical advances for offshore exploration and production are in no short supply. The new lease of life breathed into North Sea developments with the coming of subsea systems and floating production units has gathered a fresh momentum, spinning off a wave of additional ideas for tackling still harsher environments and deeper waters.

Adding to this, the fundamental shift in research and development from oil companies to major contractors – one effect of the downsizing and outsourcing philosophies of the early 1990s – and the current trend for large-scale mergers in the service and supplies sector, have brought a sharper competitive business edge to the industry, demanding technical innovation for survival.

Drilling developments

In the drilling sector, extended reach, horizontal and designer wells, all targeted at maximising the interface between well bore and producing pay zones, have quite rapidly become everyday tools in exploration and production. Now multilateral wells, using a single producing well bore fed from a number of side branches, are edging into the picture, offering significant cost savings compared with drilling several separate holes.

With 'life of field' economics now carrying greater importance to an increasingly cost-conscious industry, minimising downhole interventions for workover or repair during the operating life of a well has also become the focus of attention.

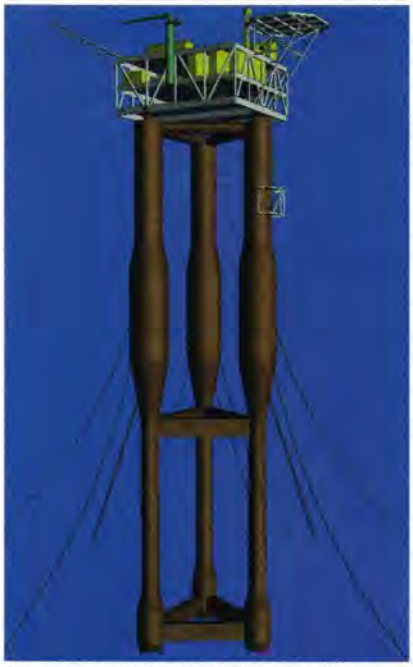
A case in point is in the £1.25bn Chevron–Conoco Britannia gas condensate development, one of the largest remaining gas fields to be developed in the UK, which came onstream in August (see p18). Although 15 of the field's 17 predrilled wells were drilled as 'slimholes', thereby eliminating an intermediate casing string with resulting savings of up to £1.5mn per well, capex savings were not the primary deciding factor when it came to well completion.

Instead, the Britannia team opted for high quality, high performance downhole tools and materials, selected to minimise risk at each step in the completion process. Central to the approach was the use of a single tubing string carrying all components needed to

complete a well, including hangers, gauges, packers and perforating gun, in contrast to the multiple stages normally employed to achieve each step in the process. By carefully eliminating potential mechanical hitches and any moves that could damage the reservoir during completion, Britannia believes it has successfully achieved its goal of 'interventionless completion', whereby the wells will not need expensive wireline or coiled tubing operations throughout their 30-year producing lives.

Securing greater control of events downhole during production is also coming into reach with the advent of 'smart wells'. By equipping wells with downhole instrumentation and remotely operable valves, operators will be able to assess the volume, temperature and pressure of produced fluids flowing into the well from different zones of the reservoirs, and control these flows as production characteristics alter over time to optimise hydrocarbon recovery.

The complexity of the challenge has seen the development of intelligent wells move mainly into the domain of the larger service companies – Halliburton, Baker, Schlumberger, Dresser and ABB among them, with smaller players such as PES in Aberdeen contributing pioneering expertise. Already under test in the North Sea is SCRAMS (surface-controlled reservoir analysis and management system) from Halliburton and PES, installed last year in Saga Petroleum's Snorre field, where the tool is intended to counter early gas breakthrough. The ICS (intelligent completion tool) from Schlumberger and Baker is scheduled to be tried out in a Norsk Hydro well starting this month, while the Dresser/ABB ARMS (active reservoir management system) looks likely to go under trial downhole early next year.



Kvaerner's deep draft floater will be capable of operating in waters between 130 metres and 2000 metres deep.

One half of the 225-metre long cylindrical hull for the Genesis field Spar, en-route from Finland to the Gulf of Mexico.

Seabed scene

On the seabed, change is equally diverse, spurred by the number of subsea wells climbing annually by 25% in recent times. One forecast indicates 1,350 new subsea wells will be spudded in the next five years.

Multiphase metering, dominated by Norwegian manufacturers, has moved underwater, enabling operators to measure continuously the oil, gas and water components of a mixed wellstream at source. Oil companies and manufacturers have been striving for around 15 years to perfect multiphase meters, but while platform and land-based designs have been in field trials for about five years, subsea versions are only now making their commercial debut.

Norway's Fluenta recently supplied a subsea meter for installation in the Albacora field in 450 metres of water offshore Brazil, while a Framo design has been operating successfully for almost a year as the first application in the UK sector in Marathon's West Brae development in 100 metres of water. In BP's ETAP fields (see p5), two Framo meters will measure flow from six wells located up to 35 km from the central processing platform. In the forthcoming Statoil/Saga Åsgard field – billed as the largest single subsea development in the world with 60 subsea wells – 30 MFI meters will come into action with start-up next year.

Dewatering wellstreams on the seabed would help boost project economics by matching pipeline capacity to hydrocarbon flows rather than having to carry produced water too, and would also bring benefits to mature fields where water cuts from declining reservoirs can account for almost the entire production flow. ABB's SUBSIS (subsea separation and injection system) programme is targeted at this goal, the first unit soon to make its debut in Norsk Hydro's Troll C development. The programme has involved major design challenges in developing process equipment, transformers and switchgear, pumps and control systems to work in water depths up to 2,000 metres. Subsea power distribution is also the focus for GEC Alsthom's SPEED (subsea power electrical equipment distribution) project, which is now moving to a demonstration unit. With the ability to supply high voltage power to remote satellites from floating installations or existing platforms in shallower water perhaps as far as 50 km away, applications for SPEED could include running downhole pumps to boost output pressures from poorly performing wells, or powering remotely located water injection pumps on the seabed.

Subsea flowline bundle technology has also been moving ahead to keep pace with satellite developments, as difficult wellstream conditions place extra demands on designer ingenuity. For Statoil's Gullfaks subsea satellite fields, the first of which come on

DPS 210, Aker Maritime's concept for combining floating drilling and production operations in deep water.

stream this month when Gullfaks South begins producing through tie-backs to the Gullfaks A platform, Halliburton Brown & Root's subsidiary Rockwater has recently installed subsea bundles claimed to be the most advanced of their kind.

Production from Gullfaks South is prone to the formation of hydrates and wax deposition if the wellstreams are allowed to cool during possible shutdowns. To deal with this, the two bundles – 6.5 km and 3.5 km long and up to 40-inches in diameter containing production, gas injection and methanol lines, plus signal and control umbilicals – also contain hot water heating loops to maintain temperature when production halts. The hot water is provided from waste heat from the platform's gas turbines, and circulated through a closed loop adjacent to the production flowlines. The inclusion of continuous temperature monitoring at every metre of bundle length through fibre optics is another first, says the company.

Just to round off the achievement, the two bundle lengths were also mated subsea in 135 metres of water in the first diverless docking of bundles, a precision operation enabling premade rigid spools to then be used for their interconnection.

Upsurge in FPU activity

While action beneath the waves continues to make a vital contribution, the upsurge in floating production units has undoubtedly played the biggest part in changing the look of operations in the North Sea. Shipshaped and semisubmersible floating units, most notably FPSOs (floating production, storage and offloading vessels), have acted as the test beds for many technical advances, including turrets and mooring systems, multipath swivels for transferring flow streams and control signals from stationary to moving sections of vessels, and flexible risers permitting operations in deeper waters. Despite their growing notoriety for project delays and cost overruns, around a dozen new floaters are scheduled to enter Norwegian and UK waters in the next three years, the region accounting for some 30% share of the world's 200 or so floating installations.

With FPSOs continuing to push back the boundaries of operation – BP's Foinaven development on the Atlantic Margin in 500 metres of water west of Shetland came onstream last November and was joined this July by Schiehallion (see p5) – the FPSO concept looks set to move ahead further by combining production and drilling facilities together on one vessel, a move aimed to deliver attractive cost benefits to the exploration and production cycle.

Several concepts are already in the market place. Kvaerner Oil & Gas and Single Buoy Moorings have recently unveiled the FPDSO, a shipshaped design overcoming the problems of drilling through a vessel's turret, which until now has been a concern due to the increased weight placed on turret bearings. Much attention has been given to the efficient handling of drilling risers and the vertical racking and storage of large diameter risers and drillpipe below the drill floor.

The FPDSO, aimed primarily at deeper waters in harsh environments, typical of those in the Norwegian Sea, has been initially targeted at prospects in 800 metres to 1500 metres of water in the Møre and Vøring basins, where exploration is already ongoing. An additional advantage of the design is that it also able to operate in shallower water depths. A conventional FPSO could provide a development solution for such prospects, but the high cost of a separate deepwater drilling rig to complete and maintain producing wells through the life of a field could tip the economic balance in favour of the FPDSO.

Kvaerner also believes that within the next 5 to 10 years, FPSOs will be rapidly replaced by vessels using the FPDSO concept, especially for fields with compact deep reservoirs which allow for deviated wells from closely spaced subsea templates.

Aker Maritime has also entered its contender in the form of the DPS 210, a 210-metre long, 65-metre wide vessel which is capable of producing from one well while drilling a second through a multi-activity derrick. The double-bowed vessel is said to have better seakeeping characteristics than conventional shipshapes, one of the 'ends' always heading towards the main sea, with the vessel having the ability to turn up to 90° in production mode.

Designed to be dynamically positioned for deepwater drilling or combined with anchors in production, the DPS can be converted to a drilling and production vessel, with crude oil storage capacity of 450,000 barrels. Compared with a standard semisubmersible drilling rig, Aker Maritime claims the DPS could cut drilling and completion times by about one third, estimating operational savings at around $33mn a year.

Shipshaped monohulls are by no means the only installations making their presence felt in deeper waters. Recent projects in the Gulf of Mexico have provided the TLP (tension leg platform) with a return to the offshore stage, while the Aker Maritime/McDermott Spar buoy concept has notched up its first three successes as a production installation in the region's Neptune, Genesis and Diana fields.

Now another newcomer has joined the ranks of floating solutions. The deep draft floater designed by Kvaerner Oil & Gas is a multi-legged structure capable of carrying float-over topsides decks of 25,000 tonnes or more, enabling it to act as a drilling and production installation if required. A low structural weight, coupled with conventional fabrication techniques and a rapid build time of 12 to 14 months are seen as major advantages in keeping costs down. Although the concept is aimed at deep waters in the region of 2,000 metres, it can operate in waters as shallow as 130 metres, says Kvaerner, making it suitable for most oil producing regions.

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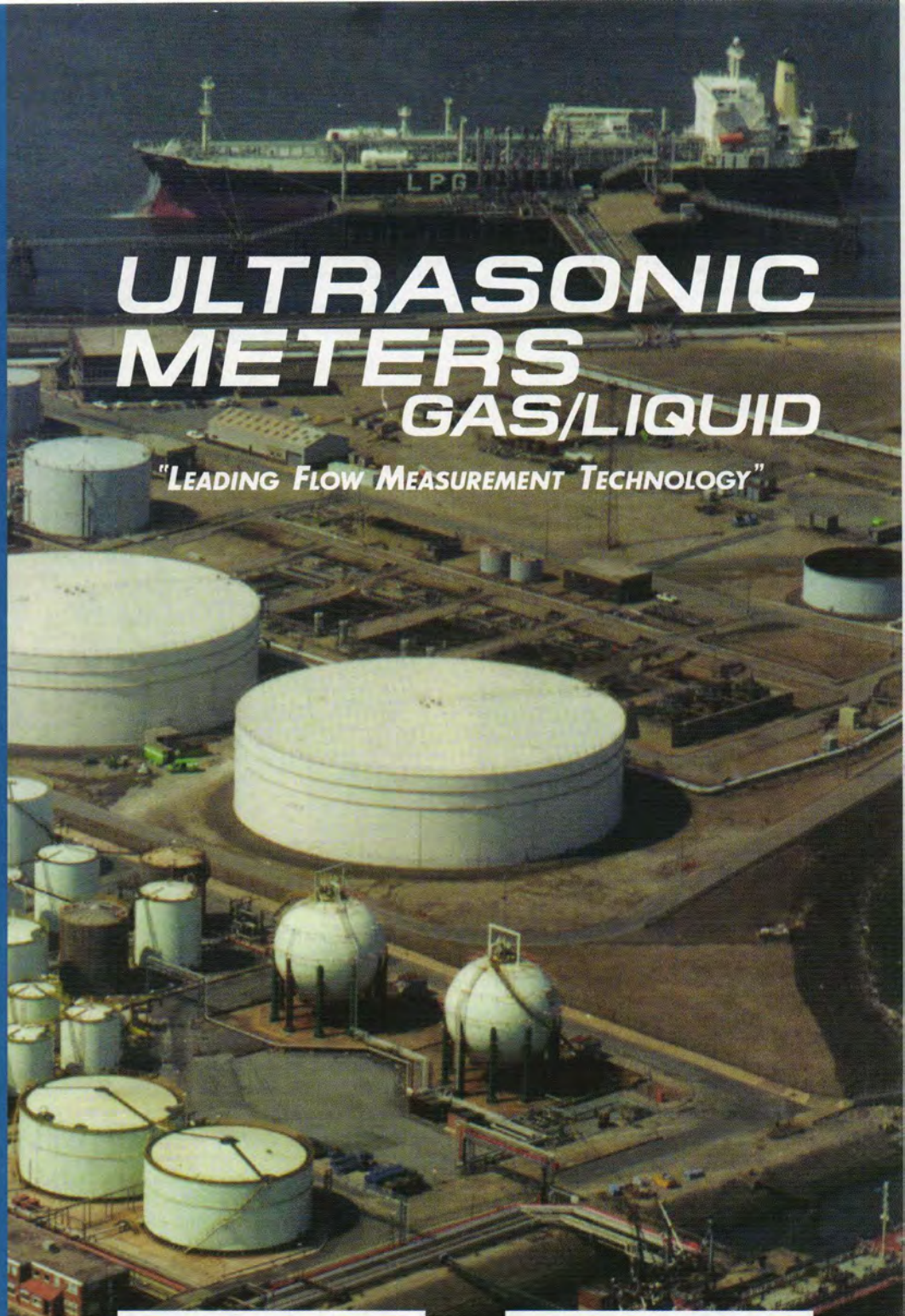

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DANIEL

Crine cuts Britannia costs

The Britannia gas field project – one of the largest and most important offshore gas field developments ever undertaken in the UK sector – started production in August, on time and nearly 20% under original budget. The application of Crine principles is said to have played a key role in the success of the project. Lessons learned from Britannia were explored in a workshop during May. *Jeff Crook* reports.

Britannia lies in the central North Sea, some 210 km northeast of Aberdeen. It contains around 3tn cf of recoverable gas reserves and 150mn barrels of recoverable condensate. Peak production is forecast to be 740mn cf of gas and up to 70,000 b/d of condensate with a field life of 30 years. To put these figures in context, Britannia's gas production equates to 8% of the UK's total gas consumption.

Discovered during the mid-1970s, the field's Lower Cretaceous sandstone gas/condensate reservoir lies at a depth of 3,960 metres. It extends over an area 40 km east to west and 10 km north to south and straddles five blocks, each with its own field partners. Conoco originally called the field Lapworth, while Chevron called it Kilda.

UK firsts

Kilda/Lapworth was re-named Britannia in January 1992 when Chevron and Conoco signed an agreement to share the duties of operator of the field on behalf of the then 12 co-venturers. It was unique among UK fields in that two leading energy companies shared the operatorship of the field. A jointly owned company called Britannia Operator Ltd (BOL) was set up to develop the field, lead by Jim Briggs as Development Director and Jeff Tetlow as Project Director.

Gas sales negotiations took place during the period when the UK gas market was being prepared for full competition. As a result, this was the first major UK gas reserve to be sold entirely to the independent UK gas market.

After considering various landfall sites, a decision was made to process gas in an extension to Mobil's SAGE gas terminal at St Fergus, northeast Scotland. The estimated saving from third-party gas processing rather than building a stand-alone terminal was put at £100mn. Gas liquids are to be handled by the Forties Pipeline System resulting in further benefits from the use of third-party facilities.

Development plan

The development plan consisted of a steel drilling, production and accommodation platform, a subsea production manifold, export pipelines and onshore terminal.

The platform is notable for its 11,000-tonne integrated deck which made maximum use of the lifting capability of the heavy lift vessel *DB102*. The integrated deck design allowed more hook-up and commissioning to be completed onshore than had been possible with earlier designs. Such a design also enabled 'loop tests' – which involve checking that field instrument readings appear correctly on the control console – to be carried out on the platform control system in the fabrication yard.

The platform's eight-legged 21,000-

tonne support jacket was fabricated at the Dragados Offshore construction site in Cadiz, southern Spain. The piles were some of the largest ever used in the North Sea – each of the 2.74 metres diameter piles was driven 105 metres into the seabed.

The integrated deck and flare boom were fabricated at Kvaerner's Port Clarence yard at Teesside while the drilling modules, compression facilities and other associated structures were built at the SLP yard across the river. The 2,300-tonne, 140-bed accommodation module was built at the SLP yard at Lowestoft. The integrated deck and six major modules were lifted on to the jacket during August 1997 by Heeremac's heavy lift vessel *DB102*.

Hook-up and commissioning activity reached a peak towards the end of 1997 with 400 personnel housed on board the flotel *Safe Caledonia*. The platform 'went live' on 3 April 1998 when the flare was lit from the first completed well.

As with many recent projects, the development drilling programme progressed in parallel with fabrication of the Britannia jacket and topsides. Ten wells were pre-drilled by the semi-submersible drilling rig *Sedco 711* through a 200-tonne template on the seabed. A further eight wells were pre-drilled by the *Sovereign Explorer* at the site of the subsea production system. Further wells will be drilled using the platform's own drilling facilities which were also used to complete the pre-drilled wells.

The 14-slot subsea manifold is located 15 km west of the platform and will contribute 330mn cf/d of the field's overall output of 740mn cf/d. There is provision for possible tie-in of remote satellite wells to the manifold, in addition to a possible future tie-in mid-line. The *Seaway Pelican* completed tie-in of the subsea production system to the platform in late 1997.

The subsea manifold is connected to the platform by a novel heated flowline system. BOL says that the hot water heating – an industry first – was a key feature for success of the project. The hot water jacket reduces the need for chemical injection to inhibit hydrate formation. Without this innovation the subsea gas production would have been uneconomic.

The two 7.5-km long pipeline bundles were towed from fabricators Smit Land and Marine in Tain, on the Scottish coast, by the world's biggest ice-breaking tug *Nordica* during May 1997. The overall bundle consists of an external carrier pipe containing the production, test, methanol and hot water pipes.

The 185-km long gas pipeline to St Fergus has a design pressure of 180 bar (gauge). The 27-inch diameter concrete-coated pipeline was laid by European Marine Contractor's lay barge *Castoro Sei* during 1997. Special attention was given to the landfall site at St Fergus where the original topography was mimicked by replacing sand and topsoil and reseeding with native plants. Biodegradable jute netting has been used to prevent erosion until the vegetation becomes established. The *Castoro Sei* also laid the 45-km liquids pipeline to the BP Unity platform.

Cooperating to cut costs

The total capital spending budget for the project was £1,855mn in March 1994 but this had been reduced to £1,555mn by the August of the same year. This saving was achieved mainly by simplifying the facilities and delaying some of the subsea work. The capital spending to first gas was, in fact, £970mn compared to the August 1994 estimate of £1,266mn – a saving of nearly £300mn.

According to BOL, alliance agreements were also central to the project's success. The agreements recognised client and contractor skills and aligned them to work together towards the common goals of creating safe and quality facilities, at below cost targets. They were also devised so that client and contractor shared the profits as well as the burden of risk between them. There were five alliances in all: the infield

alliance, the topside alliance, the subsea flowlines alliance, the export pipeline alliance and the drilling alliance.

Lessons learnt

The Britannia project set nine goals for 'superior performance'. These included zero accidents, zero environment incidents, a 10% capital cost reduction, and at least 20% operating expenditure reduction. The lessons learned during the project were reviewed by 300 delegates at the 'Britannia Lessons Learned' workshop, organised in collaboration with the Crine Network, held in May this year.

In a keynote address Jeff Tetlow emphasised the importance of safety with the statement that: 'Our work is never so urgent or important that we cannot take time to do it safely'. He said that the number of lost workdays per 100 man years was 0.6 for Britannia compared to a figure of 1.5 for previous projects and added that 'this was good, but not good enough. Our goal has been to be zero accidents'.

Tetlow referred to a passage in the Crine report published in 1994 which says that: 'The present culture is characterised by adversarial relationships and mistrust at almost every level and interface. The costs associated with manning this mistrust are huge. The culture envisaged by Crine is one characterised by team-working and openness. It is one where the full potential of people working together towards common goals and objectives can be realised and all parties have the opportunity to prosper.'

He continued: 'By coming together the way we did, Conoco and Chevron played their part in creating teamwork, openness – and the opportunity to prosper. We started off with a clear purpose. The entire team knew what was expected of them. We were aligned with a strong focus on our key objectives. These were: safety excellence, reliability, operating cost minimisation, and the lowest capital cost compatible with these aims.'

Six separate projects

Tetlow explained that all the functions within the development team had been integrated so that different disciplines worked closely together and not in isolation. Then, the development was broken down into six separate projects, each valued at between £100mn to £400mn. 'The people responsible for each of these projects were then given the freedom to use their own best execution strategies, with as few rules and as little central control as possible.'

Commenting on the project performance in meeting targets for cost reduction, Tetlow said that the goal of reducing operating cost by 20% had been met and that 'the lifting cost in the first few years will be 53 p/boe'. The capital cost saving had actually amounted to £300mn, which equated to 20% of the original budget. The capital cost for the project works out at £1.85/boe ($3/boe). He summed up by saying: 'We have moved from average in March 1994 to Best In Class'.

In a closing address Syd Fudge, Chief Executive of Kvaerner Oil and Gas, said that the Crine Network is principally known for four things: cost reduction, the introduction of function specifications, standard conditions of contract and the sharing of best practice. He added that: 'In the early days of alliancing, the industry expressed considerable concerns over the conflicting interests of suppliers, contractors and operators. Their fears have proved groundless. Britannia has been an excellent example of how you really can establish a win/win relationship.'

Field name	Oil/gas	Block number	Depth(metres)	Operator	Disc	Start up	Oil & gas reserves	Production system	Peak production(yr)
UK Onstream 1998									
Alba Phase IIb	oil	16/26	138	Chevron	1984	Dec	160mn b	via Alba platform	60,000 b/d (99)
Banff Phase II	oil	29/2a,22/27a	90–100	Conoco	1991	May	60mn b,39bn cf	Ramform FPSO	60,000 b/d, 90mn cf/d
Boulton	gas	44/21a	37	Conoco	1984	Oct		Murdock tie-back	
Britannia	gas/oil	15/29a,30 16/26,27a,b	140	Conoco/Chevron	1975	Oct	30mn,140mn cond, 85bn cf	platform via Forties	50,000 b/d
Bure/Debden	gas	49/28	31	Arco	1974,1997			tie-back to Thames	
Bruce Phase II	oil	9/8a, 9/9a, 9/9b	115	BP		Oct	61mn b, 730bn cf	subsea, to Bruce	45,000 b/d, 45mn cf/d
Chestnut	oil	22/2a	83	Premier	1984	Dec	10mn or 75mn b	FPSO	
Columba E	oil			Ranger		May		subsea via Ninian	
Corvette	gas	49/24a	31	Shell	1996	Dec	200bn cf		300mn cf/d
ETAP*	oil/gas			BP	1976–90	Oct	400mn, 35mn NGL,1.1tn cf	platform + subsea	210,000 b/d, 360mn cf./d
Gadwall	gas	21/19		Shell	1996	Mar		tie-back to Kittiwake	
Galleon Ph II	gas	48/14,15a,19a,20a	25	Shell		Oct		NNM plat, via Sole Pit	
Galley	oil/gas	15/23a	150	Texaco	1974	Mar	28mn b, 40bn cf	FPSO via Flotta	35,000 b/d, 50mn cf/d
Gannet E	oil/gas	21/30		Shell		Mar		via Ekofisk	8,000 b/d
Halley	oil/gas	30/11b,12b	242	Amoco	1981	End-98		subsea via Ekofisk	7,000 b/d
Jacqui		30/13		Phillips					
Janice	oil	30/17a	9	Kerr-McGee	1990	Aug	25mn or 70mn, 17bn cf	semisub via Judy	55,000 b/d
Julia		30/17						subsea via Judy	
Keith	oil/gas	9/8a	123	BHP	1983		30mn b, 30bn cf	subsea tie-back Bruce	20,000 b/d, 20mn cf/d
Larch	oil/gas	16/12a	126	Lasmo	1986	2H-98	8mn to 10mn b	subsea via Brae A	17,000 b/d, 12mn cf/d
Magnus NW		211/12a		BP	1995				
Mallard	oil/gas	21/19	90	Shell	1990	Apr	25mn b, 17bn cf	tie-back to Kittiwake	16,000 b/d, 17bn cf/d
Malory	gas	48/12d,12c	21	Mobil	1997	Oct		min facilities platform	45mn cf/d
Perth	oil	15/21b	138	Amerada Hess	1992	Jul	50mn–100mn b	well tie-back	
Pierce		23/22a,27	86	Enterprise		Nov	84mn b, 202bn cf	FPSO	40–45,000 b/d
Renee/Ruby		15/27, 15/28b		Phillips	1976, 1985	Q4–98		subsea/injection/FPSO	22,000 b/d
Schiehallion/Loyal		204/20,25a,25b,205/16,21b	375	BP	1993	Jul	340mn and 85mn b	FPSO	154,000 b/d (99)
Viking extenson		49/17, 19/12a, 49/16	21–30	Conoco	1968	Mar		NNM plat	
Waveney		48/17c, 48/16c		Arco	1996	Oct	84bn cf	min facilities platform	
Wood		22/18	92	Amoco	1996	Oct		Arbroath tie-back	
DENMARK									
Lulita	oil			DUC/Statoil	1992			subsea and pipeline	5,000 b/d
Siri	oil	5604/20	61	Statoil	1995	Nov		jack-up platform	50,000 b/d
NETHERLANDS									
F2-5	oil			NAM					
K/7-FC		K/7		NAM		Jun	300bn cf	extended reach drilling	
K/7-FD		K/8		NAM		Dec	260bn cf	platform	
L9-FF		L/9		NAM		Dec	800bn cf	platform	
N7		N/7		NAM					
K/4-a		K/4b,5a		Elf		Dec	295bn cf	platform	
K/6-GT		K/6		Elf		Dec	250bn cf	platform	
NORWAY									
Gullfaks South	oil/gas	34/10	130–220	Statoil	1979	Q3–98		subsea templates via	65,000 b/d
Rimfaks	oil/gas			Statoil	1983	Q3–98	394mn b, 79bn cm	Gullfaks A platform	58,000 b/d
VARG				SAGA	1995	Q3–98		tanker export	52,000 b/d
Visund	oil/gas	34/8,7		Saga/N Hydro	1986	Oct	305mn b, 56bn cm	FPO, plat, via Gullfaks	95,000 b/d
Oseberg East	oil	30/6	160	Norsk Hydro			145mn b	steel platform	66,000 b/d
Tordis East		34/7		Saga	1993	Sep		subsea via Tordis	26–30,000 b/d

*The ETAP development comprises the BP's Marnock, Mungo, Monan and Machar fields in addition to Shell/Esso's Heron and Egret fields with the Skua field to be linked in later. The development covers Blocks 22/20, 22/24a, b, d, 23/16a and 22/30a.

North Sea field developments due onstream in 1998

Globalising for increased resilience

The UK independents – British Borneo, Enterprise, Lasmo, Cairn Energy, Hardy Oil & Gas, Monument and Premier – are looking to the future and liking what they see: globalisation, fruitful partnerships with the majors and foreign governments, and sustainable production growth. Such optimism is, of course, to be treated with caution but analysis of them by Andrew Brown of PetroCompanies' Forecast Service leads him to agree with the positive assessment of the financial markets.

The future of the UK-based independents centre on Bangladesh (Cairn Energy), the Gulf of Mexico (Enterprise, British Borneo), India (Cairn Energy, Hardy), Pakistan (Hardy, Premier Oil), Myanmar (Premier), Indonesia (Hardy, Premier), and Turkmenistan (Monument). All of these projects are pivotal to these companies' survival, but in shifting their dependence away from the North Sea, while the rewards appear bountiful, there is also greater risk attached.

With the exception of British Borneo, the UK independents are linked by their early forays into the North Sea. Initially encouraged by the UK Government, it soon became clear that the UKCS was not the free-for-all that everyone first thought. Despite a hostile operating environment that swallowed up cash and deterred many, the innovative independents survived to make useful pacts with the larger (often US) companies and develop niche roles.

Improved technologies, flexible decision making and burgeoning market capitalisations have helped these companies grow. At the same time, the North Sea has become a mature province, such that it now offers medium risk/medium reward opportunities. The Atlantic Frontier (including the West of Shetland region) today provides the high-risk component, but this is not enough for the energetic UK independents. The North Sea has provided these explorers with the wherewithal to move forward in terms of technological expertise and cash flow. While not turning their collective backs on the North Sea, the time has now come to look elsewhere.

Fiscal concerns

One of the hurdles for future value creation by the independents is, of course, taxation. In recent months, this momentum has been given a push by the UK Government which so encouraged the exploitation of the North Sea in the first place. Gordon Brown's March 1998 budget proposals to bring about changes in the UK upstream oil and gas industry, either by a Supplemental Corporation Tax, the re-introduction of Petroleum Revenue Tax (PRT), or a production royalty, has brought predictable responses from a variety of sources within the oil industry.

The fact remains, however, that the UK has one of the most benevolent fiscal regimes in the world today, and maligned oil executives are unlikely to whip up much public support. In the recent past, the former Conservative government bowed to intensive lobbying from the oil industry, culminating in 1993 with the abolition of PRT for new fields and a reduction to 50% from 75% for existing fields. With a (Labour) governmental ruling on such ring fencing due soon (it wants a 'fair take') the companies will have to like it or lump it, and, despite wailings over the high operating cost environment, the majority, if not all, are likely to remain active in the area.

Some analysts have been suggesting that the Elgin/Franklin (Hardy Oil & Gas) and Nelson (Enterprise) fields could be hit in particular by the re-introduction of PRT. Opinion is divided upon what would be in effect a rise in corporation tax, but some industry watchers believe a rise of around 5% to 8% or less would be supported by the companies. If a production royalty is imposed, this will affect all the companies, but especially those with much of their future production from the North Sea, notably Hardy (around 75% in 2000), Monument (70%) and Enterprise (60%). The majority of Hardy's perceived growth is post-2000, and abroad.

Rising debt underpins growth

The UK independents are rationalising their portfolios, concentrating on their core areas and maintaining financial discipline in order to capitalise on new opportunities. Assuming sustained capital expenditure, consensus forecasts show these companies generally becoming cash negative over the next couple of years. But the rising debt to total capital employed ratio is matched by financial returns coming through from forecast higher production. These higher levels of gearing (Cairn apart) are not unduly worrying, as these UK independents have some world class assets backing them up.

Looking to reduce their debt, Monument (March 1998) and Hardy (June 1998) have recently followed British Borneo (August 1997) and had rights issues. Some analysts have suggested that this is (almost) the only way these E&P companies can raise money, and, with uncertainty over the long-term oil price, they are having difficulty obtaining more debt at attractive rates. Reducing their debts though, and so lowering interest payments that were causing some analysts concern in such a low oil price climate, enables these companies to remain flexible and competitive.

Diversification comes at a price, of course – risk. All the UK independents have committed themselves to significant overseas projects. With British Borneo and Enterprise banking on both the shallow - and deepwater - regions of the Gulf of Mexico, the others are more exotic. Lasmo is building for growth with the Dacion concession in Venezuela, with Cairn (having the impressive Sangu gas field in Bangladesh), Hardy (the Bayu/Undan play in Indonesia/Australia and Sawan in Pakistan), Monument (the

Net income (£mn)	1997	1998	1999	2000	2001
Enterprise Oil	74.5	53.5	127.4	136.3	145.9
Premier Oil	48.5	36.3	48.3	54.1	60.6
LASMO	36.0	0.2	49.6	53.5	57.8
British Borneo	13.3	16.2	47.2	52.8	59.1
Cairn Energy	9.4	7.1	33.8	47.3	50.7
Monument Oil and Gas	19.6	20.8	22.9	25.6	42.0
Hardy Oil and Gas	5.9	3.2	7.7	11.4	23.4

UK independents, net income (£mn) in 1997 and forecasts to 2001

Nebit Dag permit in Turkmenistan) and Premier (the Yetagun gas field in Myanmar) all poised to deliver material growth. All of the explorers have staked their futures abroad.

All of these projects are characterised by innovative partnerships with larger/other companies, foreign government involvement and the establishment of long-term buyers. Five years ago this would have been rare, and as much of this new flurry of deals is due to the flexible nature of the independents as it is to desire of state-owned companies for foreign investment.

While Cairn has linked up with Shell, Lasmo has formed partnerships with Sonatrach and PdVSA, and Premier has high hopes of partnering Petronas, it is interesting to note that this has not been the preferred avenue of diversification. In the Gulf of Mexico, British Borneo has opted to pursue a niche role in the deeper waters through its SeaStar technology (which it should be able to use elsewhere, for example offshore Brazil and West Africa), while Enterprise has plumped for the alliance route, notably with Pennzoil in the shallow waters, and EEX Corporation in the deep waters. To acquire a launch pad in India, Cairn snapped up Command Petroleum, with its attendant Ravva field production, while Hardy bought Vaalco Energy and a 15% stake in Hindustan Oil. Instant gratification (with production and cash flow) does cost though, and Premier paid nearly £100mn ($170mn) for Sumatra Gulf Oil and Discovery Petroleum to enter the Pacific Rim.

Studies have shown that demand for gas in southeast Asia is set to grow to 70bn cf/d by 2020. The economic crisis notwithstanding, a whole new gas structure has been developing, with fixed pipelines, LNG terminals and processing plants, and gas driven power generators. If costs are cut, massive energy consumers such as India and China could turn to significant gas use.

It is no longer enough to find substantial gas reserves, however, and these companies must get their commodity to market along a secure route and within a profitable time frame. Although some of the larger players seem to be swallowing up chunks of the energy chain, all the way down the line into acquiring gas-fired power stations, companies such as Premier (with Yetagun in Myanmar), Cairn (with Sangu in Bangladesh) and Hardy (Bayu/Undan) are wisely tying up their gas reserves by long-term contracts. These reserves would otherwise stay in the ground (due to the transport difficulties involved) but the companies still have some room for manoeuvre if gas spot markets develop in the future.

Whether searching for new oil or gas reserves, or buying up small specialised E&P companies, the underlying concern is timing. Coupled with the greater inherent risk, these substantial projects can be influenced by measures outside a company's control. This is apparent in southeast Asia, where, for example, Hardy could suffer from financial instability as well as fall prone to profitability concerns over the LNG phase of Bayu/Undan, due to marginal reserves, taxation problems and disagreements between partners Phillips and BHP.

Timing is also critical in cultivating the correct image with the financial markets. A flurry of bad news, such as Cairn's 2-well failure in Bohai Bay, offshore China, can adversely affect market sentiment and serve to highlight the higher-risk, high reward strategy that the UK independents are employing. Bad

timing has hampered Enterprise with regard to the Clair field in the West of Shetland. The current uncertainty over future North Sea taxes led to the announcement in May of an indefinite development delay. As a general rule, these companies can end up writing off around 75% of their exploration budgets.

Mergers and acquisitions have, so far, been thin on the ground. Conversely their American counterparts have been snapping each other up with apparent glee, from Mesa and Parker & Parsley combining to form Pioneer Natural Resources through to Ranger acquiring Elan Energy. This may be due, in part, to the more inward looking nature of the US independents and the more immediate effect the low oil price is having, with the need for almost immediate payback.

So far the UK exploration companies have resisted finding oil through the financial markets via corporate acquisitions. With harvested profits from high oil prices in the recent past, larger players have, perhaps ominously for the likes of Hardy, been involved in share splits, increased dividends and share buybacks. As higher production levels play a prominent part in the UK independents' success story, a would-be bidder may also be looking to supplement any perceived fall in its own output. The acquisition of Clyde Petroleum by Gulf Canada showed that this can be messy, with the North American sector favouring cash flow multiples as a way of valuing E&P companies rather than the UK method of net asset value.

Capex plans holding up

Central to any E&P company's growth is its ability to re-invest. These UK independents are participating in large-scale projects, involving several years' worth of development, which are necessary to sustain their performance. Consequently, they cannot bail out at the first signs of weakness. Enterprise hinted that, if prices remain around $15/b, it will consider lowering its exploration budget by 9% in 1998, to come in at around £155mn, but its development budget is solid at £500mn.

With oil revenues of critical importance to the Middle East countries, once the oil price hits the $15/b mark, Opec directly or indirectly has to defend its main source of income. Until a workable compromise to cover over the hostilities between Saudi Arabia and Venezuela is reached, management and analysts alike see a (fairly) prolonged period of low oil prices, probably around the $14/b to $16/b (Brent) mark.

Those companies appealing to the financial community are those offering visionary business practices, sound and coherent growth strategies and risk-diversified exploration portfolios. The consensus brokers' opinion is strongly behind British Borneo (the acquisition of a stake in the Discovery pipeline assets consolidates its Gulf of Mexico position and should auger well for maximising its return in the region) and Enterprise, who many see as weathering the low oil price with its strong (if slightly delayed) production growth in the near-term.

Premier has its devotees too, presumably attracted by its strong financial position. It should meet its 1998 production targets and it has plenty of upside exploration potential. An audacious rights issue by Monument has been well received by the financial community, partly because, not being underwritten, this has saved the company around £1.25mn. The company has strong institutional support which clearly believes that with the proper funds in place, Central Asia can become a prolific area.

For British Borneo, in the Gulf of Mexico, the Morpeth, Allegheny and King Kong fields, coupled with the innovative SeaStar system, should see first production of 35,000 b/d of oil in late 1998, 15,000 b/d of oil and 21mn cf/d of gas in late 1999 and 90mn cf/d of gas in 2000, respectively. Cairn's production rise has already begun, with its 1997 production coming in at 14,085 boe/d, of which its subsidiary Command contributed 8,389 boe/d. The increase reflects the addition from the Ravva field, and this will soar further after the Sangu gas field in Bangladesh came onstream in June1998 at 160mn cf/d.

Due to maintenance problems and production difficulties in 1997, Enterprise has revised its main, short-term production target of 300,000 boe/d, by one year, to 2000. This will largely be met by output from the Norne and Valhall fields in Norway, together with Pierce, Banff, and Bittern in the UK North Sea. The alliance with Pennzoil in the Gulf of Mexico could, depending on the size of the infrastructure required, begin production by 2000.

In the past 12 months, Hardy has looked again at its current portfolio and made upward revisions of expected production levels. Much of this growth is still to come, with current production from the Harriet field in Australia and five months of output from the PY-3 field in India offsetting lower production from the Banff, Birch and Ravenspurn North fields in the North Sea. Assuming no technical difficulties, it is aiming for production in the range of 25,000–30,000 boe/d in 2000, before rising to 35,000–38,000 boe/d by 2001/2002. In addition, the recent Woollybutt oil discovery in Australia (late 1997) and the Sawan gas play (early 1998) in Pakistan could add further volumes on top of this, with the company hoping for 50,000 boe/d by 2003.

Lasmo set a production target of 200,000 boe/d for 1997, and, although falling short, believes that it can improve to hit around 250,000 boe/d in 2001. In addition to its main operating areas of Indonesia and the UK, the company is looking to develop its activities in Pakistan, the North Africa/Mediterranean region, and Venezuela, and, longer-term, in the South Atlantic, where it has high hopes for its acreage position in the Falkland Islands.

Monument is concentrating on the Nebit Dag licence (with the Burun oil field). In early 1998, output was just 6,000 b/d but with the company entitled to incremental production increases, and, through taking responsibility for all previously drilled wells in the region (around 200), production is expected to be stepped up to 20,000 b/d by the end of 1998 and (possibly) between 35,000 b/d and 40,000 b/d by 2000. It exported its first 4,700-tonne cargo of oil from Aladja in Turkmenistan to Baku in Azerbaijan in March 1998, and, perhaps more significantly, it signed an oil exchange deal with Iran's state-owned National Iranian Oil Company. Monument will transport its oil from Turkmenistan to northern Iran and swap it for oil in the Persian Gulf.

Premier's impressive rise in production of 65% in the first 6 months of 1997, to 46,700 boe/d, was nearly maintained as full year 1997 output came in at 43,900 boe/d. This year on year production growth of 37% keeps the company on track to meet its main short-term target of 60,000 boe/d by the end of 1998. Further out, the company is optimistic of producing more than 100,000 boe/d by 2001, as its projects currently under development come on stream. Most of this production will come from Indonesia (30%) and Myanmar (30%), with the rest from Pakistan (15%), UK (10%), Albania (10%), and Australia (5%).

The final word

It is in the very resilient nature of successful E&P companies not to be risk averse – they would not survive if they were. Through their continual search for unexplored regions, whether it is in the largely unknown Falkland Islands or areas not previously available (Caspian and Middle East), use of improved technology, and reserve creep, such companies will always look to exploit the situation to their advantage. Instead of counting the number of countries that the UK independents are involved in, what is important is how focused the management is, how innovative its geologists are, and how true it remains to being a pure upstream company.

Improving North Sea safety

The 'Changing Health & Safety Offshore' conference in July witnessed a great deal of raking back over the last 10 years since Piper Alpha. In fact some participants wondered if there was sufficient looking ahead at the three-day event organised by the Health & Safety Executive, given that it was supposed to set the agenda for the next decade. Equally, was enough attention paid among the mass of techno-speak to the role of the ordinary 'shop floor' worker in the process of creating a safer North Sea? asks *Jeremy Cresswell*.

For trade union officials and offshore safety representatives, the well attended HSE conference was clearly a milestone insofar as significantly more emphasis was placed on people factors than at previous, comparable conferences.

Indeed the UK Offshore Operators Association (UKOOA) was even seen to formally recognise the role that trade unions could play in the future when, on behalf of UKOOA, Mobil North Sea's Ian Montgomery delivered a keynote speech on how to improve the risk decision process.

Core to his presentation was a new model by which projects could be evaluated... from the routine through to ground-breaking developments where oil companies could no longer assume they would get their own way in environmentally sensitive areas, for example.

It was a system that supposedly took all major factors and stakeholders into account, not least employees, unions, pressure groups and the wider public.

Despite the model's apparent sophistication, Montgomery still asked: 'Do we properly recognise stakeholders? Do we know who they are?'

For trade unionists like Manufacturing Science and Finance North Sea secretary Roger Spiller, the model signalled recognition of the role they could play, including motivating the offshore workforce. It was long overdue, he told the conference.

Montgomery pointed out that operators had always recognised the issue of risk, but that the focus was on dealing with low risk/high consequences events, rather than the falls, trips and slips that characterised the North Sea accident scene and which were proving so difficult to eradicate.

It became clear during an open session discussion on day three of the conference that there was a lack of consistency in the approach to risk.

There was even a lack of clarity over the actual definition of risk itself and whether the judgement of specialists in the subject could be trusted. 'Experts are no longer trusted,' admitted Montgomery.

It emerged that too much reliance was being placed on risk analysis. It was a tool, no more than that. And it was fallible, given that accidents has occurred when, statistically, they had been discounted.

It was also admitted that making safety cases understandable to the average offshore worker was a problem. As for the goal setting regime itself, operators and big contractors were clear on what it meant, but it was tough on resource-strapped small and medium-sized enterprises (SMEs).

SMEs were experiencing difficulties fitting into the system. Montgomery said most wanted safety parameters dictated to them, rather than be left floundering, struggling to come up with acceptable solutions against a constantly evolving, industry-driven safety climate.

It also became clear at the conference that there were still individuals who continued to hide behind the claim that, because the North Sea was dominated by engineers, it was difficult to factor people into the safety equation.

As far as individuals like MSF's Spiller were concerned, that attitude smacked of old style North Sea management practice.

And it was all very well UKOOA building workers and unions into new models, but reality was rather different. Their views and ability to influence shopfloor attitudes to safety were still being ignored as far as he could see.

It was a pity given that improvements in the industry's safety culture depended on people getting their personal acts together ... not risk analysis and fancy management speak.

Even James May, UKOOA's Director-General, was moved to say the relationship between employers and unions should be improved. He pointed out, however, that some of the problems faced by unions were the result of physical difficulties ... getting representatives offshore in the first place.

Frank Davies, Chairman of the Health and Safety Commission, told the conference that workforce involvement in all aspects of health and safety management was one way of enhancing safety levels.

'I would like to see better workforce involvement high on the agenda for the next 10 years,' said Davies. 'I would also like to see greater involvement of the trade unions offshore.'

Head of the HSE's Offshore Safety Division, Allan Sefton, sang off the same hymn sheet: 'It is quite clear that the involvement of trade unions is a vital issue. Both sides should start talking to each other a bit, rather than talking at each other.'

But Sefton reminded delegates that the HSE's duty was to take a balanced view on the situation. 'Our role is that of honest broker. We have to maintain trust with workers, trade unions and management.'

A team of psychologists from Aberdeen University said in a paper detailing how people could be built into the safety process that a growing interest in human factor issues was having a beneficial impact on safety.

Professor Rhona Flin, Kathryn Mearns, Rachael Gordon and Paul O'Connor collectively pointed out that senior management had got the message. The Step Change initiative launched last year signalled this. But they were being watched closely by various parties intent on tripping them up if they failed. (see also p26).

'The leadership of the UK oil industry has committed itself openly to developing and maintaining a good safety culture and good safety record through Step Change, and the media, industry critics and regulators alike will be noting with interest whether this initiative succeeds or fails.'

The Aberdeen University team also threw down the gauntlet to the industry's leadership by suggesting that the concept of 'safety culture' should be dropped altogether.

In its place would evolve a culture which 'has imagination and therefore the potential to learn from previous mistakes and 'trap errors' before thay surface as accidents and incidents'.

But it would be underpinned by a 'just and fair culture' were the line between acceptable and unacceptable behaviour was clealy drawn and understood.

Safety initiatives: room for improvement

The Behavioural Issues Task Group, of the Cross-Industry Safety Leadership Forum recently commissioned a survey of the attitudes and opinions of 200 offshore installation managers (OIMs) currently working on the UKCS. The survey was organised and analysed by *Angela O'Dea* and *Professor Rhona Flin* of the Industrial Psychology Group at the University of Aberdeen, who now report on its findings.

The survey is one of a number of projects being introduced as part of the Step Change in Safety Initiative which aims to achieve a 50% improvement in safety performance across the whole industry by the year 2000. Its function was to investigate the state of safety in the offshore oil and gas industry on the UKCS at the beginning of 1998 and to identify the key outstanding safety issues.

The role of the OIM

The survey finds that OIMs occupy a key position within the offshore oil and gas industry, affording them a unique understanding of the current state of safety within the industry and an insight into likely future issues. As intermediaries between the onshore and offshore facets of the organisation, they play an important role in communicating the safety message from senior levels of the organisation to the workforce at the sharp end.

It has been recognised that OIMs possess a wealth of knowledge and personal experience of safety management that could be accessed, combined and used to the advantage of the industry as a whole and to identify and develop best practice in safety leadership offshore.

The survey

OIMs on installations operating on the UKCS in February 1998 were sent an eight-page questionnaire relating to their perceptions of the safety management systems, the safety culture, and the corporate culture surrounding the industry today. The survey also aimed to draw on the OIMs knowledge and experience of safety leadership within the industry and to highlight key safety issues. The total population identified was 314 OIMs from 157 manned installations in 36 organisations.

The results indicate a definite improvement in safety standards over the last 10 years, particularly in relation to the safety policies, procedures, and the contingency measures. It is, however, unclear whether this trend is continuing or whether improvements have peaked. For example, some recent developments, such as self-managed teams, stretch safety targets while other new safety initiatives are rated by many OIMs as having a fairly positive effect. But, other recent developments such as downsizing, delayering and stretch production targets are considered by about 20% of the OIMs to be having a negative effect on safety performance. Although OIMs rate their own installations as having a good safety culture they still perceive that there is a scope for improvement in the future.

The human factor

As well as the responsibility for the health and safety of persons on board, and for maintaining the integrity and profitability of an installation, OIMs are increasingly aware of their role as a leader. However, while most appear to be confident in their ability to take on this role in a crisis, it is the management of safety on a day-to-day basis that causes the most problems. OIMs report having the greatest difficulties in getting workers to accept safety procedures, report near misses, and in turn, establish effective rewards and/or disincentives to promote safe behaviour.

Many OIMs tend to believe that the root cause of most industrial accidents lies with the individual worker. About 55% of OIMs expressed dissatisfaction with the skills training of the workforce, and referring, in particular, to the competency of new starts and contractor staff. Carelessness, failure to follow the rules and not thinking the job through, are considered to be the factors most likely to cause an accident. Consequently, 31% of OIMs feel that there is a need to develop behavioural techniques in order to tackle such issues.

There appears to be a considerable degree of confusion over the best approach to take, whether to promote a 'no-blame' culture and the use of positive reinforcement techniques, or, whether they should be establishing effective disincentives in order to tackle procedural non-compliance. Very little guidance appears to be forthcoming from onshore management.

According to some OIMs, increasing the workers' awareness by empowering them with responsibility for safety performance is one way of improving safety within an organisation. The best way to do this is by communicating with the workforce, listening to them, acting on their suggestions and involving them in developing safety policy. The workforce will, in turn, act safely because they will be more aware of their own role in safety performance. This is a time-consuming practice that cannot be achieved if the manager is under mounting pressure from administrative tasks.

Organisational factors

While human error is a significant contributor to accidents, it is also important to

	% High/Good	% Medium	% Low/Poor
The state of safety on UKCS today	72	22	6
The state of UKCS safety 10 years ago	7	37	56
Rate your installation for its safety culture	89	11	0
Looking to the future of safety, how much scope is there for improvement?	71	20	9

Table 1: State of safety culture in UKCS

understand the work culture and management pressures that may create conditions likely to increase errors. The OIMs in this study emphasise the importance of a strong corporate safety culture and senior management commitment and support in helping them to promote this offshore. Many OIMs believe that their own organisations performed poorly at this level, particularly with respect to senior management support on a day-to-day basis. The study reveals that OIMs believe that they end up supporting onshore business needs rather than offshore safety practices. A number of issues were identified which are of particular concern:

Excessive paperwork and administration: Almost all of the OIMs cited 'paperwork', 'administration', 'e-mails' and 'information overload' as the factors that hinder them most in their jobs, caused by the volume of new legislation, new safety procedures and initiatives that have been produced in recent years. The result is that OIMs are becoming increasingly office bound, frustrating their attempts to interact with the workforce.

Communications with the beach: A similar but related problem is the quality of communications with the onshore management. Excessive amounts of e-mails from the beach and the lack of availability of shore management, when needed, is leading to frustration and dissatisfaction with onshore management.

The sharing of people, installations, and services: There is a lack of a standardised approach to rules, systems, procedures and training throughout the industry, and also in safety culture between organisations. This causes numerous problems in a workforce where there is a high level of movement of staff between companies.

Lack of time: The main hindrance identified by OIMs is the lack of time to devote to the core issues of people and working practices rather than on administration and reporting.

Outstanding safety issues

There was also a high level of consensus among OIMs about the outstanding safety issues which need to be addressed if the industry is to enjoy continued improvement in its safety performance into and beyond the millennium.

Standardisation: The increasing use of shared facilities, staff, and services suggests that it is now vital for companies to cooperate with each other in standardising the rules, procedures, systems, work practices and training systems, throughout the industry.

Competency: Belief that the standard of competence has reduced in recent years. The general consensus is that with an ageing workforce and the dearth of skilled new personnel entering the industry, it is now more important than ever to ensure new starts receive adequate training before going offshore and that adequate skills development training exists for current staff. A structured competency assessment scheme is also required.

Simplification: There is a high level of consensus among OIMs about the need to get back to basics on the safety issue. OIMs feel overburdened with new safety initiatives, procedures and legislation that are difficult to translate into working practices at the workforce level.

Management: Improved liaision with the onshore management team in terms of their day-to-day support of offshore functions is required. Specifically offshore management should be less demanding and more understanding of the roles and functions of the onshore manager. More support is also needed in terms of corporate level commitment to safety, a more cooperative leadership style, and better corporate communications.

Behaviour modification: Organisations need to clarify their position on the most appropriate way to deal with procedural non-compliance while at the same time encouraging the open reporting of incidents, and safe behaviour. OIMs recognise the need to be proactive rather than reactive about safety, and wish to move away from 'lost time incidents' (LTIs) as a measure of safety performance and towards more positive measures such as safe behaviours.

	frequency n=200
1. Health safety and well-being of persons onboard	73
2. Safety leadership	58
3. Maintaining the safety and integrity of the installation and protecting the environment	57
4. Managing the business, maximising production, generating profitable returns, controlling budgets and expenditure	46
5. Communicating with the workforce, promoting safety awareness, ownership of safety and feelings of confidence in the safety system	40
6. Emergency command	35
7. Implementing the safety management system, keeping abreast of company safety policy and complying with company rules and procedures	34
8. Coordination and control of activities	28
9. Cultivate the safety culture	25
10. Motivation of the workforce	23

Table 2: The roles and functions of the OIM

Safety leadership

The message is clear on the OIMs' perceptions of the best ways to manage safety, and good safety leadership has three main elements:

1. Being a role model for safety, visibility at the worksite, participation in the work tasks, and consistent application of company safety policy.

2. Communication with the workforce, increasing their awareness of safety, taking their suggestions on board, involving them in planning, and empowering them by getting them to accept ownership and responsibility for safety performance.

3. Being proactive about safety, taking action in safety related matters, following up on incidents and accidents appropriately, generating the support of workers and supervisors, establishing effective disincentives and reward systems, promoting an open atmosphere for reporting incidents and accidents.

It would seem that OIMs' perceptions of safety are becoming more positive but there is still some way to go in developing the right environment for optimum safety performance. Many of the outstanding issues identified by the study are achievable through improved communication and cooperation between the levels within each company and indeed between the companies themselves. It is clear that the OIMs are now experiencing a considerable amount of pressure in their work due to lack of time and a heavy administrative workload. This could be attributable to the recent flood of new initiatives. What is now required is some time to consolidate and internalise the learning of recent months and years.

A modern approach to under balanced drilling

Operators are continually searching for new technology which will allow them to recover hydrocarbons more efficiently. One technique recently applied in some areas of the world is under balanced drilling (UBD) which not only offers improved rates of penetration but also improved productivity. *Martin Meinster* and *Robin Mair* of The Expro Group provide an overview of today's modern approach to what was once a universal methodology for drilling.

During the last century all wells were drilled under balance – oil flowing to the surface once the cap rock above the reservoir was breached. After the flow from the 'gusher' had subsided the well would then be capped and the oil pumped to surface. The technique proved very inefficient and was only improved with the advent of cemented casings/liners, weighted muds and BOPs which allowed wells to be drilled without blowing out, the natural pressure of the reservoirs transporting the oil to surface.

Basically, UBD is intentionally drilling a well which has a 'dynamic hydrostatic head' that is less than the formation pressure. Drilling the reservoir using this method not only significantly reduces fluid losses and minimises formation damage, it also increases the rate of penetration (ROP), reduces differential sticking and lowers mud costs.

There are some disadvantages with this technique, however, including the need for additional equipment for well control and drilling returns processing, as well as the increased risk due to the complexity of the operation. As a result, any UBD project requires a comprehensive engineering analysis in order to ensure that the actual drilling programme benefits from utilising this technique.

Why under balanced drilling?

The decision to drill a well in an under balanced condition is based on the lithology of the reservoir and the associated drilling problems. Good candidates for drilling a well in a UB mode are naturally fractured reservoirs and re-entries in depleted reservoirs whereby the reservoir pressure is below hydrostatic pressure.

In the case of naturally fractured reservoirs, losses of mud into the fractures during drilling can be excessive – UBD will minimise this effect. However, despite the fact that the well is drilled UB and the well is producing, mud losses can still occur in the horizontal sections when it leaks away into the fractures by gravity.

Re-entries in depleted reservoirs by means of UBD can significantly improve the productivity of the reservoir as no filter cake (see below) is created and filtrate loss into the reservoir is minimised.

Skin damage

All drilling fluids contain solids. Some of these are picked up during the drilling process and some are added at the surface to change the properties of the fluid (weight, lubricity etc) by design. As the hole is drilled through permeable strata, the over pressure applied by the hydrostatic head of the fluid creates a 'filter cake' which restricts further loss of solids and fluid into the formation.

The filter cake is formed by the loss of liquid and solids to the near well bore, creating a 'damaged zone'. Once total depth (TD) is reached, a sandface completion is run. This may be a slotted/drilled liner, a pre-packed screen, a cemented liner or, in some cases, the producing interval is left with an open hole 'barefoot' completion.

With a cemented liner completion, perforating guns are used to punch holes through the liner and cement sheath and past the damage zone. This is not possible with the other styles of sandface completions and special attention must be paid to the drilling mud if long-term impairment is to be avoided.

In an under balanced mode, the mud system does not create this filter cake. However, if the UB mode cannot be sustained, drill solids can be transported into the pores of the reservoir. Due to the lack of a filter cake, high fluid losses will occur which could potentially create more damage than drilling a well over balanced. It is therefore paramount to stay under balanced at all times.

Avoiding problems

Loss circulation and the associated problem of differential sticking of the drill pipe to the wall of the hole by fluid flow into the reservoir can be avoided when the well is drilled UB. Differential sticking can be a severe problem resulting in loss of the drill string or even part of the well. This is very common when drilling is carried out on a mature field, where different pressure regimes may exist in the producing intervals across the reservoir.

Initially, UBD techniques were used to increase the ROP in formations which cause 'grinding and pasting' of the rock at the drill bit. A good example is drilling through chalk layers – when drilling through such strata in the North Sea basin while under balanced with water, ROP was shown to increase four-

fold due to the decrease of hydrostatic pressure at the drill bit causing the rock to fail more easily.

Drilling technology

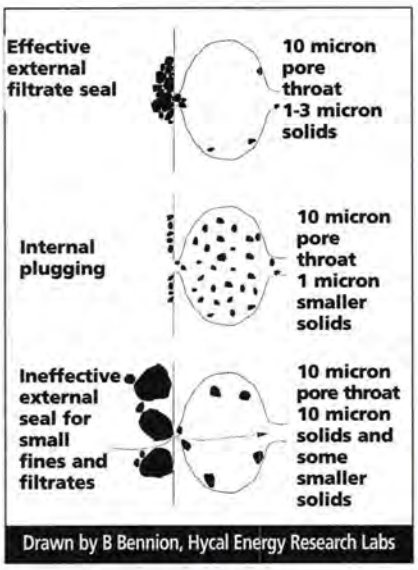
In order to obtain under balance in a safe manner, certain additional equipment is required:

- Well control – a rotating control head is located above the annular blow out preventer and allows drilling while producing the well up to pressures of 2,500 psi in dynamic mode. Under static conditions the equipment is rated to 5,000 psi.
- UB generating equipment – to decrease the weight of the 'mud' column to become under balanced, several techniques are used:
  - air injection or 'air' drilling
  - foaming of the mud by aerating it with nitrogen
  - conventional mud with a mud weight below formation pressure
  - water-based oil as a mud system
  - produced crude oil as a mud system
  - crude oil gasified with natural gas from the well
  - crude oil and nitrogen injection.

Nitrogen injection and dead crude oil from the reservoir are the two most commonly used techniques.

When utilising downhole drilling technology, additional safety systems such as non-return valves or floats are required to prevent back flow of fluids through the drill pipe itself. Apart from the standard measurement while drilling (MWD) equipment, a bottom hole pressure gauge with data transmission to surface is required to monitor the downhole pressure during the operation to prevent over pressuring the formation.

A surface process system is also required as the drilling returns will now consist of a drilling mud, cuttings and reservoir fluids such as oil or gas. These fluids need to be separated from the cuttings and mud prior to directing these streams to the normal cutting handling system of the rig. Gas and oil, if not used for re-injection, need to be disposed.



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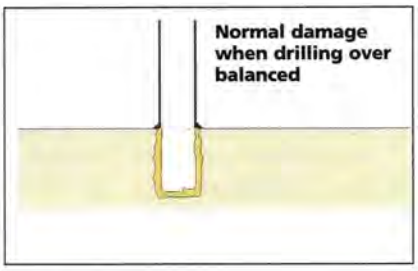

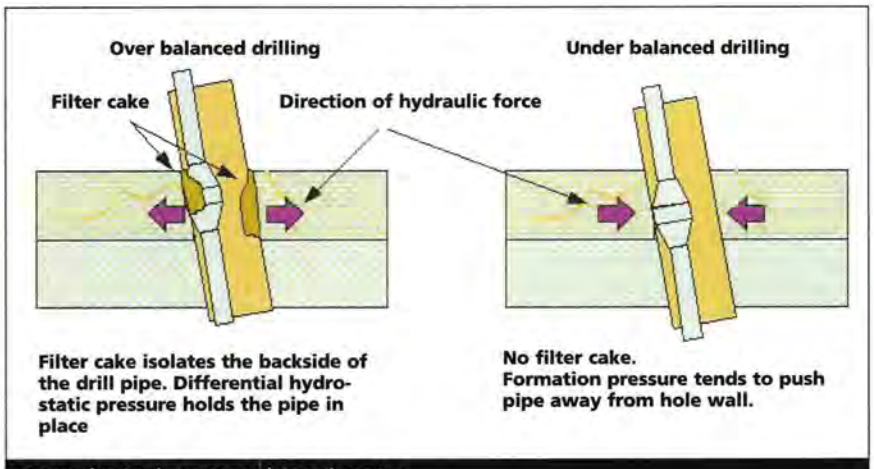

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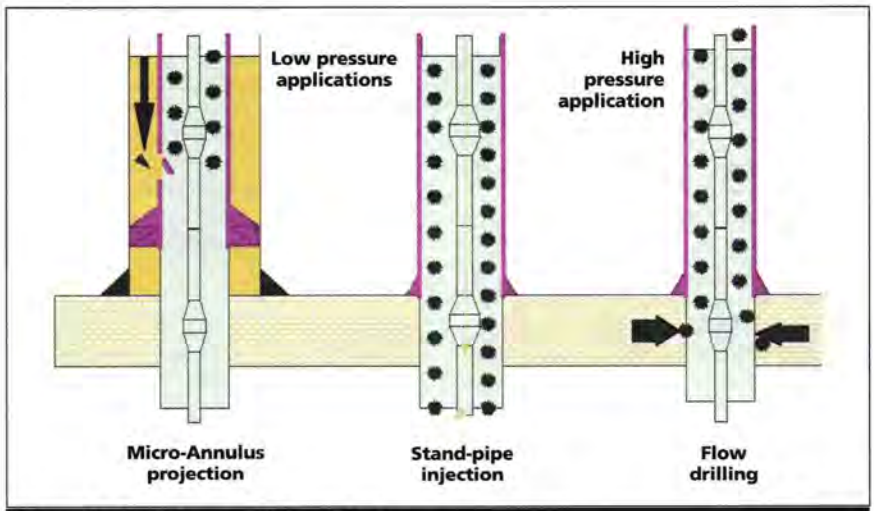


Drawn by Curtis-Lunan and Associates Inc.

Surface equipment

As already indicated, the surface equipment required for UBD has to be able to process the well fluids as well as the drilling fluids and drill cuttings. The most common system is that used in Canada for relatively low pressure oil wells. The system is based on a standard well test package where the surface pressure is controlled by a choke. The well fluids are then routed to a very large 'four phase' separator where solids, gas and liquids are separated. The separator system is a gravity-based system which has several disadvantages:

- The retention time can be significant – for example a typical grain size of 300 to 400 microns will settle at a rate of 1 metre per 15 to 20 minutes in 8 centipoise oil. The oil which still contains cuttings is then directed to the rig system where centrifuges are used for further treatment. If hydrogen sulfide is present, the rig pit system is completely by-passed. The mud still

containing fines is re-injected into the drill string.

- Large volume portable vessels become extremely heavy unless they have their operating pressure limited to a maximum of between 250 psi to 500 psi.
- The pressure drop is taken upstream of the vessel. The high velocity of the fluids and solids downstream of the choke can cause erosion on chokes and piping.
- The systems can be quite noisy due to gas expansion in a relatively large vessel.
- High deck loading for offshore applications.
- Poor slugging control.

The Expro approach

The Expro Group has designed a new style of UBD surface package which aims to eliminate the majority of the problems found with other systems currently available. The system is of modular design and, if the flow parameters deviate, can easily be adapted to suit requirements without jeopardising the design philosophy.

The well/drilling fluids leave the rotating control head – or in the case of coiled tubing drilling, via the test tree nippled up on the production tree – where they are directed to the surface process equipment.

The fluids flow via large bore piping into the high pressure mud/gas separator. Here, the free gas is separated and flows via the back pressure control valve, which controls the well head pressure. This maximises the stability of the surface pressure even in the case of a liquid slug. The chance of generating an overbalanced condition downhole is therefore minimised. The gas is routed via a knock out separator to one of the burner booms, flare stack or to an existing production installation.

The liquids and solids flow via a hydraulically actuated level control manifold which controls the liquid level in the mud/gas separator to the liquid/solid removal vessel. Parallel to this level control manifold, an optional high pressure sampling manifold obtains samples from the liquid stream on a continuous basis.

The solid/liquid removal system extracts the solids from the liquid phase by means of a bank of cyclones. Ideally this vessel should be positioned upstream of the level control manifold. However extensive choke tests have indicated that the life of the choke is too short to be practical if high pressure drops with concentrated slurries are experienced. It was thus decided to position the vessels downstream of the level control manifold. The overflow and underflow from the liquid/solids separator are directed for further degassing and separation.

The overflow flows to standard process equipment, eg a high flow capacity test separator for further degassing. The underflow is directed to a surge tank for degassing and the liquid routed to the rig mud system where centrifuges remove the remaining fluid from the drill cuttings. The off-gas is routed to the burner booms and flared off. The clean drilling fluid is then returned to the drilling system to be circulated down the well.

The process package is designed to be suitable not only for the drilling operation but also for clean-up and testing once the completion has been run in the well.

To date Expro has worked on above reservoir drilling ROP improvement using UBD where significant time savings have been established. It is currently manufacturing sets of UBD equipment for operations in Europe and the FSU where the UBD package will be used to drill through the producing interval. ●

Martin Meinster is Technical Sales/Engineering Supervisor, Expro Continental Europe Region.

Robin Mair is Group Marketing Manager, Testing and Environmental, Expro North Sea Ltd.

Tracking down the key to massive energy stocks

Scientists in three UK universities are helping oil and gas companies to overcome a major obstacle to offshore production and unlock massive untapped under-sea energy reserves.

Geologists at Durham, geochemists at Newcastle and engineers at Heriot-Watt are working in a multi-disciplinary team to solve the problem of overpressure which is a major challenge to drilling, particularly in many new deepwater areas, where large reserves are located. Overpressure is created by the weight of rocks which have been rapidly deposited (such as in the mouth of a river) and when large volumes of gas are created deeper in the earth. These processes may have taken place millions of year ago.

Phase 1

The teams of scientists have completed a three-and-a-half year programme, GeoPOP (Geosciences Project investigating OverPressure), backed by 13 oil companies with nearly £1mn and large quantities of rock samples from their drilling operations. The study was mainly based on the North Sea, but the findings have global significance, states Durham University.

The GeoPOP team has developed new techniques for determining overpressure, including a computer model to relate pressure data to the geological environment. The team has looked at all the potential mechanisms which generate overpressure. One of the key discoveries of Phase 1 concerned the use of fluid inclusions (small pockets of water, oil or gas) trapped in rock which act as tiny time capsules recording the history of fluids passing through the rock millions of years ago. Using a special laser microscope at Newcastle University, the team has devised a technique to measure the liquid:vapour ratio in the inclusions. This provides indications not only of the temperatures and pressures at that time, but also the type of fluid present. It has been found that oils in the past are very different from those found today – providing a clue to how oil and gas traps are filled.

Phase 2

A second phase, GeoPOP 2, is now underway with the support of 14 companies. The team plans to analyse the rocks forming the pressure barriers which seal in the oil and gas subject to the overpressure. High resolution equipment will be used to analyse rock samples and the data will be used in computer modelling by the oil companies to predict the pressures in their future wells.

Until recently, offshore oil and gas production has been confined mostly to the relatively shallow coastal shelves such as the North Sea, Gulf of Mexico and West Africa. More recently, however, drilling technology has developed so that deepwater areas can be explored where a new generation of oil and gas fields will be located. Many of these are suspected to have overpressure which can increase project costs if it is not predicted in advance. During Phase 2, GeoPOP will concentrate on offshore areas of Europe, North America and southeast Asia, reconstructing their geological history and establishing when overpressure was created and how much pressure remains.

Sponsors of GeoPOP Phase 1 were Amerada Hess, Agip, Amoco, Arco, Chevron, Conoco, Elf, Enterprise, Mobil, Norsk Hydro, Phillips Petroleum, Statoil and TOTAL. All except Agip and Chevron are so far subscribing to Phase 2 with the addition of BP, BG Technology and Texaco. ●

Bacterial bugs beat oil pollution

Cleaning up old refineries and tank farms can be expensive and time-consuming. However, a Glasgow-based company has devised a new technique that will help petroleum companies deal with large-scale hydrocarbon contamination in cold climates efficiently and economically, writes *Gordon Cope*.

A visitor arriving in Norwich by train is greeted by three main sights: an immense Gothic cathedral towering over the oak-lined streets, the River Wensum winding through the valley, and a large, abandoned industrial park. The ancient city, located 160 km northeast of London, is peaceful, picturesque... and polluted.

Down by the main train station, large lorries trundle across a flat, 19-hectare plot of brownland known as Riverside. They are preparing the site for a £50mn complex of homes, offices, restaurants, shops and a swimming pool. 'The government has a policy to develop brownland, and Gazeley and Railtrack wish to help promote that policy,' says Nigel Mottram, site Project Manager for developers Gazeley Properties Limited and Railtrack. 'It will have a big impact on Norwich.'

But the Riverside site had a problem that is all too common in Britain. Over the course of a century, a cocktail of diesel, lubricating oil, kerosene and polycyclic aromatic hydrocarbons (PAH) had leaked into the ground from the gas plant, railway yard and aeroplane factory that once occupied the site.

Diesel, gasoline, lubricating oils and kerosene can seriously contaminate crops, residential land and aquifers. One barrel of gasoline, for instance, can make one million barrels of groundwater undrinkable. Some PAH compounds, which can be formed by the incomplete combustion of fossil fuels, are known carcinogens. Before any new buildings could be built on Riverside, the developers had to reduce the contamination to strict levels acceptable to the Environment Agency.

View of overall site at Riverside, Norwich *(Photo courtesy of* Eastern Daily Press*)*

Cleaning challenge

The challenge of cleaning up Riverside was undertaken by a Glasgow-based remediation firm that specialises in large-scale hydrocarbon contamination in cold climates. 'Riverside is the largest bioremediation site ever undertaken in Britain,' says Colin Grant, Managing Director of Bio-Logic Remediation Ltd. 'We are looking at 32,000 cm of contaminated soil, enough to fill three aircraft hangars.'

In many ways, Riverside is serving as an example to petroleum companies as to how a large, hydrocarbon-contaminated site can be effectively cleaned up using bacterial action. 'We have 970 old gas production sites,' says Phil Kirby, Director of Construction and Environment in the Property Division of BG plc. 'Following business changes, many of the 970 former gasworks sites are now surplus, and we want to dispose of them. It helps nobody to have a fenced site. Everyone wants to bring land back into beneficial use.'

But, like Riverside, virtually all old gas plants have pollution problems. 'Many of our old sites are contaminated with a range of inorganic and organic contaminants, including benzene, coal tars, phenols and ammonia, that have been left behind by old processes,' notes Kirby.

Legal liability

The Department of Environment, Transport & Regions (DETR) is responsible for drafting legislation to cover contaminated land in the UK. The existing legislation, policed by the Environment Agency, obliges local governments to identify contaminated land and gives them the authority to force owners to clean them up if the pollutants threaten waterways or aquifers.

Relatively few sites are actively threatening the environment, however. What has many petroleum companies worried instead is the potential for legal headaches arising years after polluted land has been sold. 'Everyone is extremely nervous of legal liability, especially because of what's happened in the US,' says Kirby.

In order to deal with legal liability, British Gas follows a full-disclosure route. Before BG plc sells any land, it first investigates to determine pollution

levels on site. It then documents all clean-up work and a potential buyer is fully informed of the history, pollution and remediation of the land. 'The buyer must accept they understand the site condition at the time of sale,' says Kirby. 'We've cleaned up 70 sites in the last 12 months and sold 40.'

While this approach discharges the company of future liability on the land, cleaning up the unwanted sites is still costly. 'BG plc has booked a £448mn provision to remediate lands,' says Kirby. 'It spent approximately £100mn by the end of 1997 and expects to spend a further £70mn this year.' Multiplied throughout the petroleum industry, the cost of remediating land quickly surpasses several billion pounds, exceeding the return on the sale of cleaned-up land to developers. Any solution that lowers the cost of remediating land will impact directly on the oil and gas sector's profitability for the next decade.

Landfilling has traditionally been the cheapest and most common method of restoring land. Companies simply dig up polluted soil and transport it to a clay-sealed pit, where it can be disposed for £15–20/cm.

But communities have begun to object to contamination-filled lorries rolling through their streets. 'A developer recently bought a piece of land in a posh area of Oxford, and the locals didn't allow them to cart the contaminated dirt off,' says Grant. 'We'll see more local opposition in the future.'

In addition, as landfill sites become more and more scarce, especially in southern Britain, costs will continue to escalate. 'Gate fees could rise to £200/tonne for certain wastes.'

Bioremediation solutions

More recently, *in-situ* bioremediation programmes have gained acceptance as an alternative to 'dig and dump'. Wells are dug into the soil and air and nutrient-laden water is injected to encourage the breakdown of contaminants through bacterial action. The process works well on small sites, such as benzene leaks from storage tanks.

If the site is located over impermeable soils or barriers that prevent 100% access, however, it can take years to clean up a spill, especially if the area of contamination is extensive. 'In-situ technologies are excellent for petrol stations, but they are not going to work on a 40-acre refinery site,' says Grant.

Larger sites can be more effectively cleaned up using ex-situ bioremediation programmes, such as landfarming. Under landfarming, the soil is dug up and fertilizer is added. The soil is then spread thinly over a field, where natural bacteria can digest the pollutants.

Bio-Logics Site Manager Chris Prentice inspects bioremediation windrows at Riverside

While landfarming can effectively clean up large sites, it has two significant drawbacks: many complex hydrocarbons are resistant to simple bacterial action, and the biological action comes to a complete halt during cold winter months. 'Land-farming often takes a number of years to work, which is too long, and it doesn't get all the contaminants', explains Grant.

As a graduate of the University of Strathclyde with a BSc in Biotechnology and Economics, Grant began to look for a viable alternative. 'The goal was to develop a process that would work in under one month and compete on cost with landfill.' Working with an American colleague, he developed a new, ex-situ bioremediation process that incorporated fungi.

Fungi, which include organisms such as mushrooms and penicillin mould, normally feed on dead plant material, such as leaves and tree trunks. They create their own food by secreting enzymes that break down complex organic molecules into simpler, more edible compounds that indigenous bacteria thrive on. When Grant mixed certain fungi into a biopile, even tough, hard-to-decompose PAHs fell to the onslaught in record time. 'Fungi are like artillery, breaking open the defences and allowing easier access for the bacterial foot-soldiers,' says Grant.

In 1995, Bio-Logic field-tested the new process out on an old oil refinery site in Glasgow. 'It was fast, efficient

and got all the pollutants,' he recalls. Further projects followed, and his company now has 11 employees and projected revenues of £2mn for 1998, and is growing at a rate of 50% annually.

Riverside clean-up

When Gazeley decided to develop Riverside, it looked at its decontamination options. 'Originally, the client wanted to use land-farming, at a cost of £20/cm,' says Steve Brown, Manager of May Gurney Construction Ltd, the construction contractor for the site. 'But land farming would have taken 75,000 square metres of space and one year of time. They didn't want to take up so much space and time.'

Hearing of the project, Bio-Logic approached May Gurney with a proposal to clean up the site by August 1998, using only 25,000 cm of space, at a cost of £25/cm. 'Bioremediation was more expensive, but we chose it because of the saving in time and space,' says Brown.

Bio-Logic took samples back to the lab and tried different microbes, fertilizers and catalysts. Once they had determined the best mix, they returned to Riverside where the contaminated soil was dug up and moved to a quiet corner on the site. Nutrients, straw and fungi were blended into the first 6,000 cm tranche, and the mixture was piled into windrows three metres high and 200 metres long. In order to control the moisture content, each row of soil was covered with tarpaulins.

Inside the windrows, the fungi excreted enzymes that broke down large-chain hydrocarbons into simpler structures. Bacteria in the soil, spurred by the nutrients, began to multiply. The temperature rose to 30°C, even during the coldest winter months. The bacteria ingested the hydrocarbon pollutants and converted them into carbon dioxide and water.

Instruments were installed to monitor the temperature, gas and moisture levels within the windrows. 'When the oxygen became depleted, we turned the windrows over,' explained Chris Prentice, Bio-Logic's site Project Manager.

The soil was mixed using a 'windrow turner', a £60,000, custom-designed aerator that can churn 5,000 cm of soil a day. During the first few days of remedial action, the soil was turned two or three times, with repetitions gradually being reduced to one per week after two weeks.

Within three weeks, pollutant levels dropped from 500 ppm to 20 ppm. The friable, clean soil was stockpiled for eventual landscaping purposes on site, and the process was repeated on the next tranche.

In spite of discovering an extra 8,000 cm of polluted soil over the course of the project, decontamination of the site is on schedule and May Gurney is looking forward to beginning construction as planned in September 1998. 'The Environment Agency set tight, low thresholds, and Bio-Logic met those thresholds,' says Manager Steve Brown. 'We'd use it again.'

The remediation site is adjacent to a former gas works

Legislative hurdle

Unfortunately, bioremediation faces hurdles unrelated to technology. 'A problem we get with bioremediation is that the government waste management people say bioremediation is a processing of waste, and therefore needs a licence,' says BG plc's Phil Kirby. 'It takes four to six months to get the licence, which is a needless impediment'

'We're not in the business of creating regulatory obstacles,' responds Sue Herbert, Acting Head of Land Quality at the Environment Agency. 'We recognise that remediation techniques are aimed at environmental improvement, but we also are aware that remediation techniques may lead to negative environmental impacts. We want to ensure that regulatory control is able to deal with these.'

Bioremediation companies are pressing for a system where the government issues them a portable licence that can be transferred from site to site, alleviating the need to re-apply for a licence for each new project. Herbert notes that there is an amendment in the legislation that provides for a mobile plant licence, and operators like Bio-Logic can apply. 'We are actively developing detailed guidance for staff to handle applications.'

Grant maintains that the government is not paying enough attention to the latest bioremediation advances. 'Although local Environment Agency officials have visited the Riverside site, senior managers, who make decisions on the future of our industry, haven't shown the slightest interest in Norwich, when they should be working hand-in-glove with us,' he says.

'The fact that there has been no visit from head office should not be seen as a lack of interest, or that we're not familiar with the technique,' counters Herbert. 'The Agency has a national centre which provides a high level of expertise on technical matters. We are aware of new remediation techniques, and we are keen to see their use in appropriate circumstances.'

Phil Kirby at BG plc suggests that the government should clarify the statutes regarding contaminated land. 'Guidance notes for section 57 of the Act (which defines contaminated land), have not been published in two years,' he says. 'The Environment Agency and all regulators need to know.'

Petroleum Review understands from a government source that the delay is due to an extensive consultation process, an intervening general election, and government spending priorities.

The road ahead

While the remediation industry and government sort out the muddle, the pressures to find viable clean-up alternatives will inevitably mount. Landfill costs will rise, opposition from local communities to transporting contaminated land will grow, legislation from the EU will become more strict, and environmental groups will focus the glare of media attention.

In the end, the success of Riverside may serve as a prototype to all in dealing with contaminated land. BG plc, which ran its own bioremediation experiment at Leeds, found that its process ground to a frustrating halt in the cold of winter. 'If Bio-Logic's bioremediation solutions are faster and will work on our cocktail of gasworks contaminants, we'd be interested,' says Phil Kirby.

Ice protection on the Grand Banks

The development of oil fields offshore Newfoundland presents a major challenge because of sea ice and icebergs that are carried down from the Arctic by the southerly flowing Labrador and Greenland currents. The Hibernia platform, which came onstream in November 1997, was a major milestone in the opening up of this difficult oil province. While the Hibernia field's 750mn barrels of recoverable oil justified the construction of a permanent structure which could resist the impact of a multi-million tonne iceberg, a more cost-effective solution was required for Terra Nova, the second largest oil field off Canada's east coast. *Jeff Crook* reports.

The development solution finally adopted for Terra Nova involves a floating production facility which can be relocated if iceberg impact appears unavoidable. The use of a disconnectable floating facility has focused attention on the ice monitoring and surveillance procedures, and these formed an important aspect of the development application.

The field has estimated recoverable reserves of 300mn to 400mn barrels of oil and was discovered in 1984. It lies 350 km eastsoutheast of St John's, Newfoundland. It is being developed by a consortium of companies led by Petro-Canada, known as the Terra Nova Alliance. Start-up and first oil are expected by the end of the year 2000 by which time just under $2bn will have been invested in the project. The total capital and operating cost over the 15-year field life is estimated to be $4.5bn.

The floating production, storage and offloading (FPSO) vessel, which will be connected to subsea wells, is being built by Daewoo Heavy Industries. It will have a processing capacity of 125,000 b/d and storage capacity for 960,000 barrels of oil. It will be moored by means of a nine-leg chain-link mooring system weighing approximately 5,000 tonnes.

The FPSO will be an ice-classed vessel designed to resist the impact of drifting sea ice. Doris ConPro Engineering, a joint venture company formed between Doris Engineering (designer of the Hibernia GBS) and the Newfoundland ConPro Group, will provide project management, engineering analyses and services for the steel vessel design.

Ice management plan

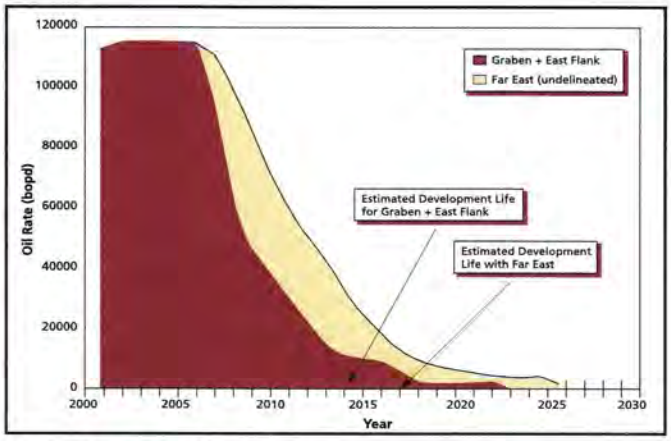
However, it is unlikely that the steel hulled FPSO will be able to resist the impact of the very largest icebergs. So there is provision to disconnect and relocate the vessel if an iceberg impact is unavoidable. A disconnection would be a major operation involving the shutdown of production, disconnection of the production risers and mooring lines, disconnection and flushing of the loading lines, and moving the vessel to a safer location. Timely disconnection will, of course, require reliable ice monitoring and surveillance systems, and this is an important aspect of the ice management plan.

The ice management plan was outlined in the development application submitted to the government. The document discusses how the operator will deal with the hazards of both icebergs and pack sea ice and outlines the organisational structure.

The offshore installation manager (OIM) will have ultimate responsibility for ice management in the field but will be supported by an onshore ice coordinator and offshore ice observer. The onshore ice coordinator will be based in St John's during the ice season and will liaise with an offshore ice observer on the FPSO. The ice coordinator will be responsible for collecting and collating ice detection and surveillance information from a variety of sources and relaying this information to offshore personnel. Ice monitoring data received from observers on the FPSO and its support vessels, helicopters, fixed-wing aircraft and drilling rigs will be supplemented with ice intelligence received from other sources, such as neighbouring operators and government agencies.

An ice alert chart is to be drawn up to specify the action to be taken as icebergs enter specific zones around the FPSO. It is intended that every effort

Location map



Production profile for Terra Nova

will be made to tow icebergs away from the FPSO by means of ropes deployed from the support vessels. If these measures fail, and an iceberg impact is unavoidable, then a controlled disconnection will take place. The FPSO may also be disconnected if sea ice in the vicinity of the facility exceeds five-tenths coverage.

Secunda Marine Services will supply two offshore support vessels for the project under a C$50mn, four-year contract. In addition to their ice management role, the support vessels *Trinity Sea* and *Burin Sea* will provide marine support, re-supply, anchor handling and standby services. The vessels are to be completely rebuilt before starting their support role in 1999.

Seabed protection first

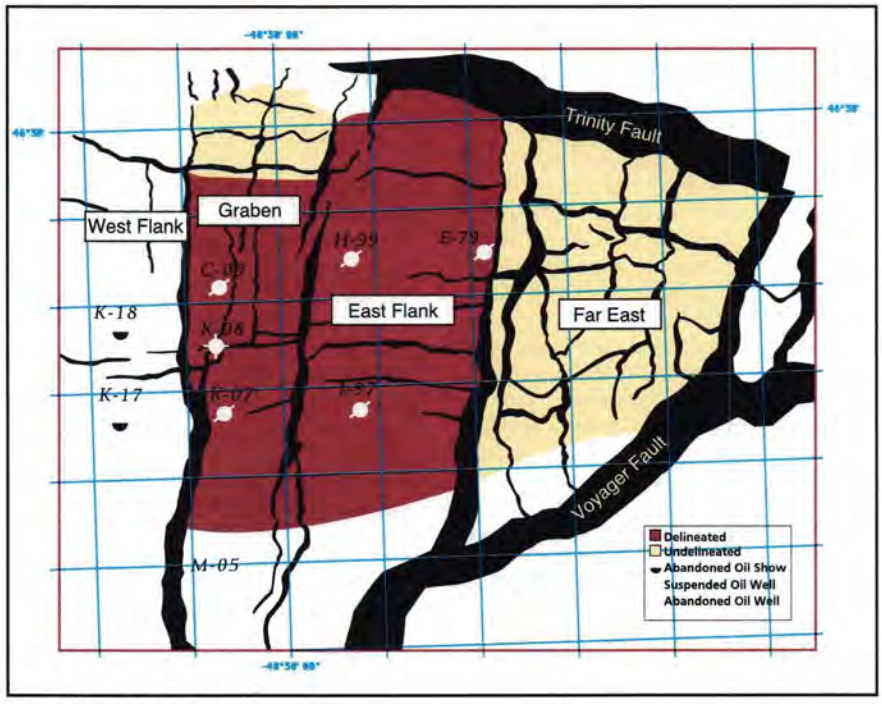
While the FPSO can be moved out of the path of an iceberg, the equipment on the seabed is permanently installed and could therefore be vulnerable to damage from the keel of a passing iceberg which can produce deep gouges in the seabed. To prevent damage to subsea equipment from an iceberg gouge the equipment will be installed in excavated 'glory holes'. Seacore Ltd was awarded a C$20mn contract towards the end of 1997 to excavate glory holes to protect the 24 subsea wellheads and their templates.

This is the largest excavation project of its type ever undertaken and it also uses the latest technology. Seacore will use a large diameter drill to excavate the seafloor instead of conventional dredging equipment. The excavated material will be lifted into a barge and deposited on the seabed a short distance from the glory hole. The drilling equipment will be deployed from Cal Dive International's ice-class construction vessel *Sea Sorceress*.

'Construction of the glory holes [for the wellheads] is a critical factor in the overall timing of the Terra Nova project, certainly as it relates to preparation for drilling', explains Terra Nova Development Leader Mike Cantle. The work will take place during this summer and the next, to enable six wells to be drilled before the start of production in the year 2000.

Four 12-metre deep glory holes will be constructed in all. Their base areas will range from 16 metres by 16 metres, to 56 metres by 16 metres. 'We look forward to working with Seacore to successfully deliver what will, undoubtedly, be one of the largest underwater excavations ever made for an offshore hydrocarbon project,' says Jean-Michael Dumay, President of Coflexip Stena Offshore International, on behalf of Coflexip Stena Offshore Newfoundland, the Terra Nova Alliance member company responsible for managing the contract.

Halliburton Energy Services is responsible for the provision of integrated drilling and completion services for construction of the subsea wells. Six wells are scheduled for completion prior to start up with potentially another 18 wells thereafter. The wells will be a combination of horizontal and highly deviated wells.



Terra Nova geology

Hibernia first

The Hibernia development lies 315 km off the coast of Newfoundland and involved an investment of $4.4bn. The production platform stands in 80 metres of water and is claimed to be the world's first iceberg resistant gravity based structure (GBS). The massive reinforced concrete structure has a storage capacity of 1.25mn barrels of oil and a production capacity of 150,000 b/d of oil, from up to 64 wells. Oil is exported from the field by shuttle tankers from a subsea crude oil loading facility. The development plan has provision for two of these subsea loading facilities although it is understood that only one of these is fully installed at present.

The GBS consists of a caisson surrounded by a 15-metre thick icebelt. Four columns extend up from the base of the caisson to support the 50,000-tonnes topsides. The half-million tonne GBS was built at a drydock and then at a deepwater site, both in Bull Arm, Newfoundland. It was filled with seawater ballast after it had been towed to its field location. Another half-million tonnes of ballast, mainly iron ore, was used to anchor the structure firmly in position to resist the effects of iceberg impact and wave forces.

The external icebelt wall has outward projecting 'teeth', and is supported from the caisson by a lattice of internal walls. Dave Luther of Mobil (one of the field partners) said that the geometry of the icebelt has a strong influence on iceberg loads, and thus received careful attention during the design. Finite element models were used to estimate loads on the structure using iceberg data developed by Mobil Technology Company in Dallas. This iceberg data included the number of icebergs annually crossing the Grand Banks 48N parallel and other statistics about iceberg mass, speed, height, shape etc.

An important aspect of the ice management plan is to deflect icebergs away from both the platform and loading system. Dave Luther explains: 'The support vessel uses a rope to lasso the iceberg and then deflects the path. This technique has been successfully used and was, in fact, used for a small iceberg during the tow of the platform from Bull Arm to the Hibernia Field for installation'.

Review and update of petroleum measurement tables

Representatives of the American Petroleum Institute (API), American Society for Testing and Materials (ASTM), and Institute of Petroleum (IP) are working as a joint committee to update the Petroleum Measurement Tables which provide the oil industry with a sound basis of measurement for custody transfer and internal material balance control. *Ron E Beaty*, Chairman, API Committee on Petroleum Measurement, and *Derek R Brown*, Chairman, IP Petroleum Measurement Committee, outline the review process and proposed updates to the tables.

First developed in the 1930s, the Petroleum Measurement Tables account for the thermal expansion of liquid hydrocarbons and are used by oil producers, carriers, refiners and marketers to adjust petroleum densities and volumes to the base temperatures of 60°F, 15°C, or 20°C, which are common standards in various parts of the world.[1]

The tables were last updated in 1980–82 (commonly referred to as the 1980 Tables)[2] and superseded the crude oil and refined products portion of the 1952 Tables. The update constituted a major data collection and analysis effort and resulted in the re-establishment of the temperature effect on density and volume for crude oils and refined products as separate, independent functions.

Most importantly, the 1980 Tables replaced the 1952 printed Tables with mathematical formulas which, in turn, allowed for the incorporation of the tables, via standard implementation procedures, into computer subroutines.

Over the past 16 years the 1980 Tables have provided the industry with a sound basis of measurement for custody transfer and internal material balance control. However, in the light of different analytical methods, the discovery of new crude oils, the introduction of new refined products and advances in computer technology, some aspects warrant reviewing.

Review of table basis

The committee first reviewed the basis of the tables. The current tables are based on data obtained in the late 1970s on a large and comprehensive set of world crude oils and refined products.[3] These data were then used to establish the generalised crude oil and refined products tables. Over the years, questions were occasionally raised concerning the quality of the density measurements used to build the 1980 Tables and how globally representative the hydrocarbon samples collected actually were.

A joint team of experts from the API and IP reviewed these matters and concluded that any difference between density measurement techniques available today and the measurement precision and generalised correlation methodology used in the development of the 1980 Tables would not have a significant impact on the tables for the following reasons:

- If buyers and sellers have concerns about the application of the tables to unique petroleum liquids, the standard provides a procedure whereby an individual or specialised crude oil and/or product can be characterised based on its particular thermal coefficient of expansion. This section of the tables is referred to as 'Table C'.
- The tables, apart from the individual or special applications, are statistical averages of data taken over a wide range of hydrocarbons and are represented by a generalised correlation. Because of the generalised nature of the original work, new oils are adequately represented by the 1980 Tables.
- Incremental improvements to the base data or the inclusion of a few additional samples would not significantly modify the generalised correlation for each class of petroleum fluid.

Based on these points, the joint committee concluded that the type of programme required to produce a new database for the tables is not justified.

Update proposals

Although the basis of the tables was judged sound, advances in computer technology and the increased discrimination of density values, together with other changes, meant that various aspects of the tables could now be updated.

Although a number of updates are proposed, the standard itself remains the implementation procedures which have been adopted as International Standards ISO 91-1 for reference temperatures 15°C and 60°F, and ISO 91-2 for reference temperature 20°C.

The implementation procedures are step-by-step instructions on how to install the computer subroutines for equations, calculation sequence, rounding of numbers, etc, which generate consistently the correction factors that comprise the tables. The proposed updates to these procedures will affect the A, B, C, and D table categories – Generalised Crude Oil, Generalised Products, Individual/Special Applications and Lube Oils respectively.

At the introduction of the 1980 Tables, computer technology had not advanced to the point where consistent answers would be returned without

complex rounding and truncation routines. However, following recent technological advances and established standards on how computer processors and machine languages maintain mathematical precision, most of today's computers will return consistent answers without any intermediate rounding and truncation steps. Thus, the implementation procedures can be simplified, leaving only a final rounding step.

The current standard called for five significant digits which resulted in five decimal place numbers for volume correction factors (VCF) for temperature corrections above 60°F, and four decimal place numbers for corrections at or below 60°F.

While this is mathematically correct, the VCF tables represent non-dimensional factors which are intended to be used as multipliers. Thus, the factor of exactly one (eg 1.00000) is a given as the base temperature. The significance of the VCF lies in the offset from the base temperature, or offset from 1.00000. Following this line of thinking, the significance of the 'one' digit can be ignored allowing for equal decimal place discrimination throughout the table. In order to provide consistency, the committee has agreed to establish a five decimal place VCF standard both above and below the base temperature.

Complete sets of printed 1980 Tables were impractical at the full level of accuracy of the standard which provides temperature and density correction values in increments to the nearest tenth (0.1). Therefore, abbreviated printed tables were issued for the convenience of users who were not yet computerised which listed every fifth value of temperature and density increments at 0.0 and 0.5 intervals. Consequently, these printed tables were not the standard and led to interpolation for temperature and/or density values in between the 0.0 and 0.5 increments. Users following this practice incorrectly assumed table values adhered to a linear function so that many interpolated values were in error.

However, over the years computers and more powerful hand-held computational devices have become predominant. Furthermore, computer file storage media technology has advanced. Therefore, the committee plans to issue in conjunction with the updated tables, computer files on compact disk (CD-ROMs). These CD-ROMs will replace the printed table format for publishing this standard and will provide the full range of temperature and density correction values, thereby eliminating the interpolation problem. As such, the CD-ROM versions will completely match computer-generated VCFs. As with the existing printed tables, the CD-ROMs are not the standard but represent one way of adopting the standard implementation procedures to produce VCFs via a particular computer language. This can equally be achieved by using various other programming languages.

Due to operational needs the committee is also extending the range of the tables for both temperature and density to -60°F (-50°C) and -10°API (1.165 kg/m³), respectively. These extensions will be a simple mathematical extension of the tables based on the k0 and k1 values present at the current lowest temperature/highest density (0°F, 0°API) limit of the tables.

In 1980, the measurement of density to only a 0.5 kg/m³ discrimination was adequate. However, over the years the capabilities of density measuring equipment now available in the laboratory has increased to an accuracy of 0.1 kg/m3. Thus, the metric version of the tables will be updated to a 0.1 kg/m³ level of discrimination.

Finally, the lubricating oil tables (category D) were never equipped with implementation procedures, although the IP published derived procedures for Table 53D. Plans are to establish the algorithms and implementation procedures for all the lubricating oil tables in the same fashion as the crude oil and refined products tables.

This update will review and, where necessary, revise the *API Manual of Petroleum Measurement Standards*, Chapter 11.1, Volume X, *Background, Development and Computer Documentation*, to incorporate all previous supplementary publications to the tables referenced in ISO 91-1.

Other areas of work

The committee continues to enhance the Petroleum Measurement Tables in other areas. For example, verification of the Product Tables (B Tables) for Reformulated Gasoline (RFG), as well as research on the effects of RFG and oxygenate blends has been undertaken. Only a portion of this work has been completed and further funds are required in order to continue.

A specific table for natural gas liquids (NGL) and liquefied petroleum gases (LPGs) has also been established. This table designation has been assigned as the E Table. The 60°F, Relative Density version of the E Tables (23E and 24E) are currently being balloted, while the other versions (53E, 54E and 59E, 60E) are being documented. Plans are to continue this line of work by also establishing specific NGL, LPG compressibility relationships. However, this will require more laboratory analytical work, which has yet to be approved.

The Intraconversion Tables, too, are being updated and/or under review. These list the unit conversions for US Customary and Metric units used in petroleum measurement. They also list weight-to-volume conversion factors. Some of these tables have been updated within the last 12 months to incorporate an implementation procedure. This was done to facilitate the advent of computerised accounting software packages which need to report on a weight basis. This work continues to progress.

Consideration is also being given to updating the Compressibility VCF Tables (ie correction of volume for pressure) for crude oil and refined products (the non-NGL/LPG liquid hydrocarbons). While no new laboratory work is planned, some updates are in order. The current compressibility tables have no set implementation procedure and the density/temperature ranges covered by the compressibility tables do not coincide with the volume/density VCF Tables. This non-alignment will be further exaggerated by the extension of density and temperature for the density/volume tables which is already underway. Thus, a proposal to update these compressibility tables is currently being drafted.

Future plans

Based on the various updates described here, the API/ASTM/IP committee plans to revise the A, B, C, and D designated sections of the Petroleum Measurement Tables. Work is underway and plans are to begin balloting the new tables by early 1999. Work to develop the E Tables for light hydrocarbons is also underway but under separate guidance. Updates to the Compressibility Tables and the Intraconversion Tables are still under consideration.

Once the joint committee has completed the updates, the documents will be forwarded to the ISO/TC 28/SC 3 Secretariat so that they can be circulated to member bodies for their comments and approval. ●

References

1. *Petroleum Measurement Tables*, ASTM D 1250, API Std. 2540, IP 200 (1952).
2. *Petroleum Measurement Tables*, Volume X – *Background, Development, and Program Documentation*, ASTM D 1250-80, API Chapter 11.1 (Std. 2540), IP 200, ISO 91-1 (August 1980).
3. Hankinson, R W, West, K I, *The History, Background and Applications of the Petroleum Measurement Standard 2540-80*, American Petroleum Institute, Committee on Petroleum Measurement Conference, New Orleans, March 28, 1995.

NEW Publications

Proceedings of the 15th World Petroleum Congress*

(Available from John Wiley & Sons Ltd, Baffins Lane, Chichester, Sussex PO19 1UD, UK). Vol 1 ISBN 0 471 97540 0; Vol 2 ISBN 0 471 97541 9; Vol 3 ISBN 0 471 97542 7; three-volume set ISBN 0 471 97538 9. Vol 1 – 160 pages, Vol 2 – 616 pages, Vol 3 – 600 pages. Price (hardback): £259 per volume or £795 for three-volume set.

The Proceedings of the 15th World Petroleum Congress – which took place in Beijing, China, on 13–16 October 1997 – brings together 115 scientific and managerial papers detailing the nature, cost and impact of new developments in petroleum technology. Divided into three volumes, Volume 1 incorporates the plenary addresses and subject index. Volume 2 compiles the papers on exploration, production, refining and petrochemicals while Volume 3 focuses on those sessions relating to natural gas, reserves, environment and safety, business management, research and transportation.

Vibration

Charles Reeve (Coxmoor Publishing Company, PO Box 72, Chipping Norton, Oxon OX7 6JU, UK). ISBN 1 85617 234 1. 170 pages. Price (hardback): £35 (£30 to Petroleum Review *readers).*

Vibration monitoring is widely used as one of a number of on-line techniques to show malfunction or deterioration in machine operation. These techniques can be used to assess the need, if any, for corrective action and can lead to improved safety and cost savings. This book – part of the 'Machine & Systems Conditioning Monitoring Series' – sets out the basic concepts of vibration and vibration measurement as appropriate to rotating and reciprocating machinery and is based on user experience. It aims to set down good practices in the field of vibration monitoring.

Central and Eastern European Service Stations: Trends and Competition in an Expanding Market

(Available from MarketLine International, 16 Connaught Street, London W2 2AF, UK). 160 pages. Price: $1,495.

This report provides analysis of key trends shaping Central and Eastern Europe's fuel and forecourt retailing market. It analyses the likely effects of privatisation and the reduction of subsidies on fuel prices as Eastern Europe becomes increasingly market oriented. It also includes an in-depth examination of the state of each country's economy, as well as market share information on their domestic petroleum industries. Eleven country profiles contain market volume and value analysis, network and market share analysis, and forecasts to the year 2010. Company market shares by country are also listed. The report also contains 19 company profiles.

Companies in a World of Conflict*

John Mitchell (The Royal Institute of International Affairs, Chatham House, 10 St James's Square, London SW1Y 4LE, UK). ISBN 1 85383 536 6. 256 pages. Price: £15.95.

Globalisation is confronting today's companies with choices that are not simply economic, nor clearly defined within a political 'safe haven' of national or international laws and regulations. This publication examines the dilemmas that confront multinational companies and describes the mechanisms by which they are challenged to account for the social as well as the economic consequences of their actions. A number of examples are provided, ranging from extraterritorial US sanctions on Iran and Libya, to human rights and the petroleum industry, and the experience of companies responding to public and private sanctions on South Africa during the apartheid regime.

Surface Production Operations: Design of Oil-Handling Systems and Facilities*

Ken Arnold and Maurice Stewart (Gulf Publishing Company, Book Division, PO Box 2608, Houston, Texas 77001, US). ISBN 0 88415 821 7. 443 pages. Price (hardback): £93 ($115).

This manual describes the equipment and processes commonly used in oil–water separating and treating systems. It also shows how to select the appropriate piping and pumping systems. Now in its second edition, the book features a number of new sections, including offshore platform considerations, factors affecting oil and gas separation, potential operating problems, hydrocyclones, multiphase pumps and reciprocating pump operations.

**** Available from IP Library***

IP Stats Service

The new subscription year for the IP Statistics Service has just started with the mailing of the first quarter's statistics for delivery into inland consumption of petroleum products for the UK, Scotland and Northern Ireland. Subscribers have also received updated data sheets including a new sheet for the world's top 50 oil companies. To subscribe or for more information contact Sue Tse on +44 (0)171 467 7115, e-mail: **sytse@petroleum.co.uk**

Improved Library facilities

Visitors to the IP Library now have access to two computers. One allows access to the Library databases and use of CD-ROMs including *Petroleum Abstracts* and *ILI Infodisk*. The other provides direct access to the Internet (charged at £6 per hour) or *Reuters Business Briefing* (for £1 per minute). Searches can also be carried out by IP Library information staff on your behalf (for an additional charge) if you are unable to visit in person.

Website award

On 12 August 1998 Catherine Pope and Catherine Cosgrove accepted the 1998 European Special Libraries Innovation Prize awarded for 'Best innovative practice in special libraries' for the IP website. The £500 award, sponsored by the Library & Information Show, financed the purchase of a scanner and related software for use in further enhancement of the website.

IP website

Many of the Library's information and data sheets are now available on the IP website. Hundreds of addresses and links are provided as well as a glossary of petroleum terms and a page of job vacancies. The address is **www.petroleum.co.uk**

Library/Information staff contact list:

- Liliana El-Minyawi – LIS Assistant (+44 (0)171 467 7113)
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  Information queries, online searches, desk research
- Sue Tse – Information Officer (+44 (0)171 467 7115)
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- Catherine Pope – Webmaster (+44 (0)171 467 7112)
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- IP Library e-mail: **lis@petroleum.co.uk**

IP THE INSTITUTE OF PETROLEUM

Annual Dinner 1999

Wednesday 17 February
Grosvenor House, Park Lane, London W1

The 1999 Annual Dinner will be held on Wednesday 17 February during the Institute's internationally renowned IP Week. Only IP Members may apply for tickets to the Dinner, and the ticket application form will appear in the October 1998 edition of *Petroleum Review*. To avoid possible postal delays, non-UK Members should write now, to the address below, for an application form.

IP Week 1999

London:15-18 February

IP Week in February is the focal point in Europe each year when leading figures in the oil and gas industry migrate to London for an intensive round of conferences, industry and trade association events, company meetings and social events. The Institute's own programme of events, including the IP Annual Dinner, forms the core of these activities.

If you would like your name to be added to the mailing list to receive a copy of the IP Week 1999 Programme of Events, please contact:
Pauline Ashby, Conference Administrator, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK. Fax No: +44 (0)171 255 1472 e-mail: pashby@petroleum.co.uk

If you are interested in becoming a member of the IP, please contact Tracey Connellan, Membership Manager at the above address or telephone +44 (0)171 467 7121

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Corporate member of the Institute of Petroleum

Progress in ISO/TC57

There are now good grounds for being optimistic that ISO/TC67 will deliver its standards within the forseeable future. Why?

Background – the past

Six months ago, there was much pessimism. ISO/TC67 published no standards in 1997, and failed to set itself a performance target for 1998, although the UK delegation to the 1997 Plenary Meeting had suggested a target of 20 publications. At the start of the year, the data on status and progress was largely incorrect and the TC67 Secretariat was out of touch with the situation believing that everything was going well. Communications from the Chairman appeared not to benefit from the lessons learned and clarifications developed by the AG3 advisory group.

On the bright side, TC67 did determine to establish a 'Focus List' of standards comprising 27 work items agreed as being of high importance or close to publication ('quick wins'). This list was completed by AG3 in February and is graphically illustrated in **Figure 1**. However, there was no process agreed for following it up and as a consequence four individuals (informally called the 'Focusers') took matters into their own hands in a concerted effort to assist the Project Leaders and others to overcome the blockages and deliver the documents.

A prediction made in the first quarter of 1998, that only half-a-dozen standards would be published this year, was seen by some as unduly pessimistic. In the event, no standards were published in the first half of 1998 and it now seems likely that only one will have been published by the end of the year. So why be optimistic? Read on...

Progress – the future

On 16 July 1998 ISO/TC67's 20-month standards' drought was broken with the publication by the ISO Central Secretariat (ISO CS) of ISO 13500, on Drilling Fluids. This is the first visible, public success of the 'hidden' process by which the TC67 Focus List is being progressed. Fundamentally the optimism springs from several elements that crystallised at the AG3 meeting and the concurrent API E&P Department meetings held in Dallas in June as follows:

- As of June 1998 the current status and forward programme of every one of the 27 work items on the TC67 Focus List is now known by the Focusers with confidence – this is the first time we have been in this position.
- The Focus List follow-up has successfully solved many blockages and has shown the way for the remaining 100+ work items to follow. Today, about half of the Focus List items are with ISO CS in Geneva for further processing, and will soon be issued as either Draft International Standards or Final Draft International Standards. The learnings are being collated by AG3 as a list of good practices.

API and ISO groups are increasingly working together in mutual trust and without standing on ceremony, in order to develop one set of words for use by API and ISO such that on the E&P side there is no longer a 'them and us' situation.

The TC67 Secretariat has realised that 'business as usual' is not an option and the 'hidden' process should change to be an open responsibility of the TC67 line management.

The continuing support of the Institute of Petroleum and the financial assistance from Crine Network are essential to facilitating the UK contribution to the situation in ISO/TC67 being turned around. That contribution is delivered by everyone in the committees and working groups; a final effort to complete the TC67 standards will be rewarded soon.

The Focusers have made estimates of individual document status, problems and forward programme. **Figure 2** shows their agreed view of the aggregate forward programme for the Focus List items (base from December 1997). Using the ISO Stage measures, actual progress during the first half of 1998 looks poor. However, it is believed that 'focussing' has made the difference between the trend of decreasing actual progress implied in the figure and the step change in progress necessary to achieve the June 1998 plan. This will become visible during the second half of the year.

Attention now is on ISO CS in Geneva to fulfil its role. The TC67 Secretariat, API and E&P Forum are all stressing the need to issue the documents and are making proposals and offering assistance to solve any blockages there. The conditions are right at last to go for the final push. The technical efforts of experts should be mostly complete by the end of 1999. With efficient administration, the majority of the TC67 Standards will therefore be published during 1999 and 2000. It will be great to start the new millennium with a set of global standards used locally by the petroleum and natural gas industry worldwide. ●

Graham Thomas, Chairman of BSI PSE/17

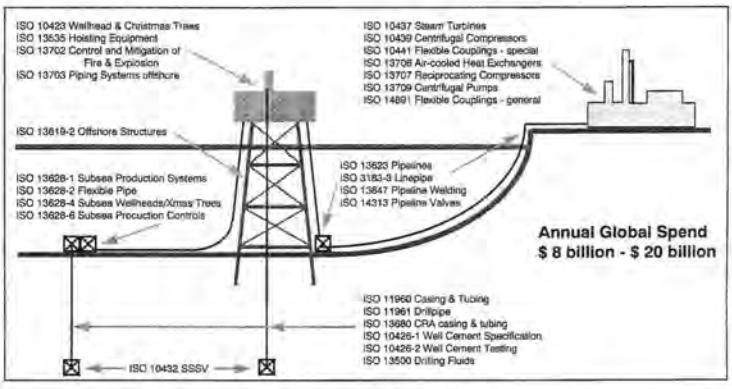


Figure 1: The Focus Items for ISO/TC67
The industry estimate of the annual spend worldwide on procuring goods and services that fall within the scope of the 27 work items is at least £8bn and maybe $20bn or more.

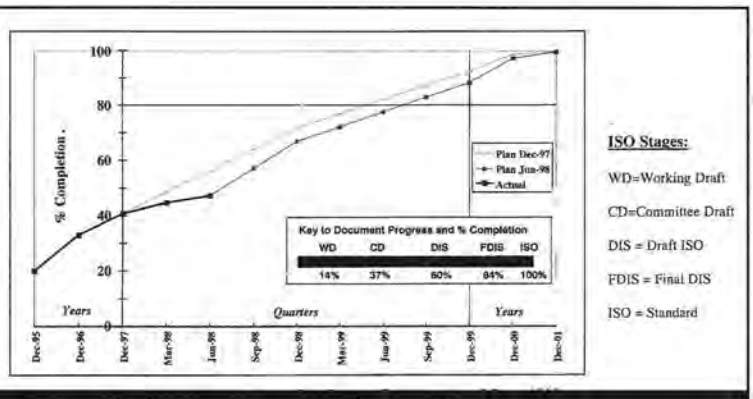


Figure 2: Focus list items – progress to end-June 1998
'% completion' is measured linearly using the time for each stage from the TC67 model programme. It is an average for the 27 work items that individually (at end-June) ranged from 14% to 84%. The overall model time to publication as an ISO Standard (100%) is 43 months from start to finish.

NEWS Technology

Use of pilot operated safety relief valves cut costs offshore

BP Exploration and Production plans to make significant cost savings by replacing the spring operated pressure relief valves on its Forties Delta platform in the North Sea with pilot operated safety relief valves (POSRV) from Anderson Greenwood. It is the first time that the Series 400 POSRVs have been used as a replacement to spring operated units, states the manufacturer.

The Series 400 units incorporate a field test and inspection facility which enable accurate set pressure verification while the valves are in service.

It is claimed that this on-line test capability, combined with the ability to perform in-situ maintenance, will allow BP to extend platform service intervals which require complete shut-down every two to five years. Such shut-downs are costly in terms of maintenance costs and lost production.

Following satisfactory performance of the POSRVs on Forties Delta, BP plans to install units on all other Forties platforms at the next planned shutdowns.

The Series 400 is said to be particularly suited for processes with set pressures between 1 and 102 barg and continuous service temperatures between –54°C and 260°C. To increase system throughput, both the non-flowing pilot and main valve can be tight as high as 98% of set pressure. This allows the system to operate near to the set pressure without

valve leakage while preventing product emissions, explains the manufacturer.

At set pressure, the main valve opens proportionally to the severity of the process upset, thus restricting product release to only that required to keep the system at/or below the set point. Soft seats are said to not only minimise leakage by ensuring absolute tightness before and after relief cycles, but also extend service life, further reducing the costs of service and maintenance.

To ensure efficient valve operation even with dirty or wet services, the non-flowing pilot minimises the entrance of dirt and the formation of hydrates. A range of options are available, including a cartridge type pilot filter and an 'Iso-Dome' for extremely dirty applications.

Tel: +44 (0)161 494 5363
Fax: +44 (0)161 494 5672

User-friendly rechargeable handlamp

The Nitech 800H rechargeable handlamp has been relaunched with a new ergonomic, lightweight design which is said to make it even more user friendly. Capable of projecting a beam of up to half a mile, the unit has spot/focus capability for search-and-find operations.

The rechargeable battery-powered lamp can undergo up to 3,000 recharge cycles during its working life. This offers considerable cost savings when compared with standard disposable batteries, states the company. The lamp's nickel cadmium batteries are also claimed to be without the problems normally associated with battery memory syndrome, as they can be safely recharged when only partially discharged, thereby eliminating the inconvenience of having to plan recharge periods. Recharging takes a maximum of 14 to 16 hours.

The unit does not need an external transformer or adapter and can be recharged in-situ using either mains electricity or low voltage supplies. It has a maximum operating time of eight hours of continuous use and is suitable

for use at temperatures ranging between –40°C and 60°C.

Tel: +44 (0)1424 852788
Fax: +44 (0)1424 851008

Integrated engineering

Pegasus Pipeline Engineering Group of Wallsend, Tyne & Wear, has unveiled an integrated suite of services called Aries, which is said to ensure plant reliability and safety through a comprehensive corrosion, inspection and analysis programme. The Aries package comprises plant inspection, defect assessment and a technical audit incorporated into a plant reliability information system manager (Prism).

Non-destructive testing (NDT) techniques locate and size metal defects and anomalies. Analyses of the cause and significance of these defects enable fitness-for-purpose assessments to be conducted. A through-life plant database is compiled from the NDT data, maintenance records and on-line instrumentation. Analytical and modelling tools in Prism then access this database to prioritise repair and rehabilitation activities, quantify future plant reliability and develop an optimised monitoring and maintenance strategy.

Tel: +44 (0)191 295 0020
Fax: +44 (0)191 234 0456

Drilling development

Baker Hughes company Centrilift has unveiled a new installation and removal method for progressing cavity pumps using wireline or coiled tubing deployment, as well as jointed connections and continuous rod.

The Through Tubing Conveyed (TTC) system uses standard electric submersible progressing cavity pump (ESPCP) technology in conjunction with progressing cavity pump equipment and can be deployed in 3½-inch and larger size tubing.

Centrilift states that it developed this technology in a bid to reduce the high cost of workovers. 'ESPCP systems are best suited for wells with high viscous, low gravity oil. Such conditions are often found in remote areas where rig costs can run as high as $300,000 and rig availability is often scarce.'

With a conventional ESPCP or ESP, a complete system can require up to 72 hours to pull and re-install. 'With TTC, rig operators can use a wireline truck to change the pump in about half a day, resulting in significant cost savings,' explains Ed Kanady, ESPCP Product Manager at Centrilift.

Tel: +1 918 342 8220
Fax: +1 918 266 4316

North Sea first for Teta technology

Coflexip Stena Offshore Ltd (CSOL) recently completed what it claims is the first North Sea installation of the CSO Group's new patented Teta technology on a high pressure gas injection riser, setting a new world pressure record in the process. The installation took place on the Pierce field which is being developed by Enterprise Oil (UK).

The Teta technology has been developed to meet the demand for larger diameter, high pressure pipes that stand up to severe operating conditions in deep water, states CSOL. On the Pierce field, it was used for an 8-inch flexible riser with a design pressure of 5,500 psi and an operating pressure of 5,075 psi. 'This is believed to be a world record operating pressure for an 8-inch flexible pipe,' says David Cassie, Manager Director of CSOL.

The name Teta is derived from the 'T' shape of the wire. Such a symmetry is said to greatly improve fatigue resistance, thereby increasing service life. Wires are available in thicknesses of 12mm, 14mm and 16mm, the latter being used on the gas reinjection riser for Pierce.

The field consists of two subsea drilling sites tied-back to an FPSO vessel, the MST *Berge Hugin*. The vessel's engines are powered by the reinjected gas and have been specially designed to operate at this high pressure. As a result, even though the pressure of the reservoir may decrease with time, the Teta wire flexible riser will have to withstand the 5,075 operating pressure throughout the field life in order to meet the engine requirements.

The new wire is also to be installed in Statoil's Åsgard field and Norsk Hydro's Visund field, both located in the Norwegian sector of the North Sea.

Tel: +44 (0)1224 744044
Fax: +44 (0)1224 744038/9

New gasket system eliminates HF emissions

Flexitallic's new Baker Gasket has been designed to eliminate the risk of accidental release of hydrofluoric acid, a by-product of the production of cleaner burning fuels, from oil refineries.

The system incorporates a low stress spiral wound gasket made from PTFE or Flexicarb filler, with a second PTFE seal fitted to the outer ring, and an integral smart detection tag which acts as an early warning of potential problems.

The gasket is specifically designed for use on Class 150 and 300 joints with no modification to the flanges or assemblies required. According to the manufacturer, its gasket design delivers a significant improvement in seal integrity with the required bolt load reduced by 15% when used with standard flanges. Furthermore, the extra PTFE layer is said to provide additional protection to the bolts from media attack and confines any emission to inside the flange closure. As an additional failsafe, should a leak occur, the medium is channelled to the detection tag where the detection paint reacts with the media to signal that urgent preventative maintenance is required.

Tel: +44 (0)1274 851273
Fax: +44 (0)1274 851386

Intrinsically safe dewpoint transmitter

Michell Instruments has launched what it believes to be the first intrinsically safe dewpoint transmitter – Transmet IS.

Designed for use throughout the natural gas and petrochemicals industries, the device offers full networking capability for up to 32 units, providing a cost effective and accurate method of sampling moisture content at a series of points on-line. Capable of measuring dewpoints over the range of –100°C to 20°C at temperatures from –30°C to 60°C, the unit is claimed to be accurate to ±1°C for dewpoint and ±0.3°C for temperature.

The transmitter is both Cenelec and FM certified and is thus suitable for use in a range of hydrogen, natural gas and propane applications, such as the moisture measurement of non-flammable and flammable gases, or the monitoring of moisture concentration on offshore platforms, in refineries or natural gas terminals.

Tel: +44 (0)1223 424427
Fax: +44 (0)1223 426557

NEWS Technology

Pigging developments in the pipeline

Pipeline Integrity International (PII) has recently developed a number of new pipeline inspection tools, including a variable bypass pig which is said to enable high resolution magnetic flux leakage (MFL) inspections to be conducted while maximising throughput.

Product bypasses the secondary pig module and passes through a high performance, variable valve on the nose of the primary module. MFL inspections can normally be carried out at speeds as high as 4–5 m/s. However, in some pipelines, normal gas speed can be up to 12 m/s or more. This means that flow must be throttled back to comply with the 4–5 m/s required by the MFL tool. The new variable bypass tool has largely removed such flow restrictions, states PII. The bypass valve is controlled to keep the tool speed below its maximum limit. The pig is able to pass along the line at its optimum inspection speed while the product can travel at much higher velocities. Capacity restrictions are dramatically reduced and the optimum tool speed maintained, maximising pipeline revenues and survey data quality.

The company has also developed a new elastic wave (EW) pig. Used for detecting stress corrosion and fatigue cracking, the device uses ultrasonic waves. These are injected into the pipe wall via transducer wheels which are maintained in direct contact with the wall. The waves pass circumferentially around the wall, reflecting from axial wall defects. The reflected waves are detected by the wheel transducers which have been specially developed to cope with all types of pipeline environment, including gas and liquid product.

PII is also developing a remotely operated Crawler pig, following its production of a tethered inspection vehicle. The Crawler uses brush assemblies in contact with the pipe wall. The pig mechanism moves these forward in steps, they then snap back into their equilibrium position, propelling the Crawler forward. According to the company, the final tool will be a bi-directional device, able to tow inspection tools in a range of environments.

A new Mapping pig which provides accurate pipeline information to supplement corrosion and defect data has also been developed for use in inhospitable geographical areas such as desert and tundra. The pig uses orbital GPS reference points taken from a survey along the pipeline. The unit travels down the line, recording accurate corrosion and defect position data, allowing the pipeline operator to quickly and easily find and repair problem areas.

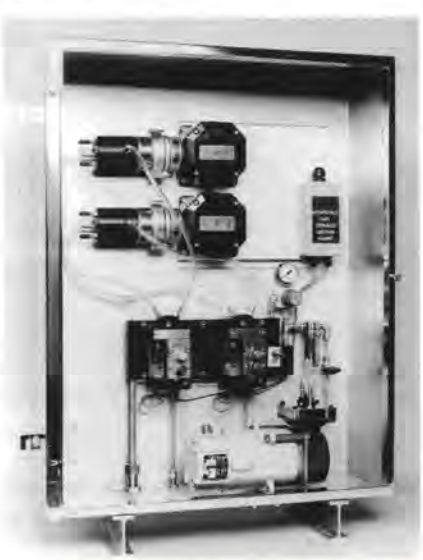
Tel: +44 (0)191 247 3200
Fax: +44 (0)191 247 3101

Remote gas sampling

Grovely Detection has unveiled a pump driven smoke and gas aspirator, GD-AP, that monitors gas in areas where there is no instrument air and where it is not possible to position a gas or smoke detector directly, such as in the moon pool and turret annulus areas of FPSOs.

The sample being measured is pulled under an adjustable vacuum by an air driven eductor. Flow rates are controlled by an integral needle valve with the velocity indicated on a flow meter. The sample is passed across the sensor and then exhausted, along with instrument air, via the exhaust port. Two models are available – constant pressure and standard vacuum.

Tel: +44 (0)1202 483497
Fax: +44 (0)1202 486658



Targeting undrilled North Sea assets

Aberdeen-based Asset Databases – which provides benchmark statistical data on the oil and gas exploration of the UKCS – has linked its Target database with UK consultant Arthur Andersen's Petroview™ package, which displays licence information in map form, to produce maps showing how exploration success varies around the North Sea.

Hydrocarbon discoveries are made, on average, in about one in four wells. However, if data is analysed by geological horizon, some areas are shown to have a higher success rate – better than one in two, explains Alistair Gray, Technical Director of Asset Databases, a wholly owned subsidiary of Asset Geoscience.

'These results can have a direct impact on the valuation of a company's exploration portfolio – the higher the chance of discovery, the higher the value of its undrilled assets,' he says. 'These analyses enable companies to rank their portfolios, ensuring that highest value targets are drilled first. In addition, these analyses can help companies value their competitors assets when looking to make asset trades.'

The Target database also includes a catalogue of untested hydrocarbon discoveries that have not yet been made commercial. Many of these finds were made several years ago and may have been regarded as non-commercial.

However, with the technology advances of the 1990s and new fiscal regimes, some of these hydrocarbons may now be commercially exploited, comment the two companies. 'Mapping of these wells using Petroview™ can help geoscientists to instantly identify unrealised potential in hydrocarbon accumulations that lie close to their infrastructure.'

Asset Geoscience
Tel: +44 (0)1224 585009
Fax: +44 (0)1224 575271

Arthur Andersen
Tel: +44 (0)171 438 3888
Fax: +44 (0)171 438 3881

If you would like your new product releases to be considered for our Technology News pages, please send the relevant information and pictures to:
Kim Jackson
Deputy Editor, *Petroleum Review*
61 New Cavendish Street, London W1M 8AR, UK

Membership News

NEW MEMBERS

Mr S Antouiou, Cyprus
Mr D P Bird, Guildford
Mr S A Brownless, Bedale
Mr M W Campbell, T Hoare & Company
Mr S D Carter, Steve Carter Limited
Mr D G Chapel, Fluor Daniel Inc
Mr M S Cowley, Sanderstead
Ms D Foster, Bridgewater
Mr C P F Fronteras, J D Edwards (HK) Limited
Mr G K Irvine, Smedvig/Navion Drillships
Mr R Khosla, Ipswich
Mr A Lee, Texaco International Production
Mr L J Loftus, Van Ommeren
Dr D Mantafounis, Nova Petroleum Limited
Mr G W Marsterson, Wickford
Mr J L Massie, Peterhead
Mr C J McKenna, Safety & Environment Limited
Mr E Mielke, Ernst & Young
Mr K P Mitra, Watford
Mr D Muskett, London
Mr C C Pocock, Livingstone Associates
Mr D A Powell, Frimley
Mr P J Rabbitte, Watford
Mr R Saligumba, Saybolt Saudi Arabia
Mr M See, M See & Associates
Mr T A Smithies, USA
Mr L Talbi, Regus
Mr G Waddell, Livingston
Mr P A Walker, Technical Standards Services Ltd
Mr R A Willings, London

NEW STUDENTS

Mr I D O Akhigbe, London
Mr I J Akhigbe, London
Ms N Carter, Preston
Ms T Elistratova, Oxford
Ms N Grouchevskaia, Oxford Brookes University
Mr A M Hall, Keighley
Mr D Lawrence, Twickenham
Mr A Mikami, London
Mr E Samain, Salford
Mr A Seleznev, Oxford

STUDENT PRIZEWINNERS

Mr P S Beilby, Arco British Limited
Mr A K Poddar, India

NEW CORPORATES

Global Business Network, 108 Paphos Street, Floor 301, PO Box 3009, Limassol 3300, Cyprus
Tel: +357 5 840190 Fax: +357 5 713490
e-mail: gbncyp@zenon.logos.cy.net
Global Business Network Limited (GBN) is an offshore trading company dealing in products and services including the supply of equipment to oil companies and training facilities strategically located in Cyprus or at client site. The company has increased its markets in the Middle East, the Gulf community centres and North Africa over a period of 13 very successful years.

GBN has sister and associate companies located in Canada, the UK, Egypt and Cyprus which are involved in high technology solutions and turnkey projects.

The company is growing rapidly but holds its values through its motto 'Based on Tradition and Focused on the Future.'

NEW CORPORATES

Economic and Legal Advisory Services Division (ELAS), Commonwealth Secretariat, Malborough House, Pall Mall, London SW1Y 5HX, UK.
Tel: +44 (0)171 7476449 Fax: +44 (0)171 7991507
Representative: Mr David Baker, Senior Programme Officer (Economic)
The Commonwealth Secretariat's Economic and Legal Advisory Services Division (ELAS) provides advice to Commonwealth Member Governments on policy, economic and legal aspects of minerals and petroleum sector development. The Division advises on policies and strategies, drafts legislation (including taxation), formulates economic and fiscal terms, drafts model agreements and licenses, assists with promotional activities, evaluates project proposals, participates and provides other support in negotiations with multinational companies and assists with the implementation of agreements. Staffed with 10 in-house professionals experienced in petroleum and mineral matters, the Division has, to date, assisted some 35 member Governments in these ways, in the process transferring knowledge and experience to member Governments.

YK Consulting Ltd, First Floor, 9 Mandeville Place, London W1M 5LB, UK.
Tel: +44 (0)171 487 5336 Fax: +44 (0)171 487 5007
Representative: Mr I Kharlamou, Director
YK Consulting Ltd is a consultancy dealing with legal, finance and trading features and is currently working with oil companies in Russia and FSU countries.

Joy Bussell, (left) Marketing Director, The Library & Information Show, presenting the European Special Libraries Innovation prize to Catherine Cosgrove (centre), Head of IP Library and Information Service and Catherine Pope, (right), IP Webmaster for their work on the IP website.

Sir John Hedley Greenborough, KBE

A Memorial Service will be held for Sir John Greenborough at St Lawrence Jewry-next-Guildhall in the City of London on 24 September 1998 at noon.

Around the Branches

A full listing of Branch events is available on the IP website:

www.petroleum.co.uk

or, if you require further information please contact your individual Branch Secretary.

EVENTS Forthcoming

SEPTEMBER

7–8 **London**
North African Gas '98: Investments & Supplies
Details: SMi Ltd, UK
Tel: +44 (0)171 252 2222
Fax: +44 (0)171 252 2272

8 **Aberdeen**
22 **London**
The Oil & Gas Industry: Getting Down to Basics
Details: McQuillan Young Communications, UK
Tel: 0171 355 1161
Fax: 0171 355 1171

8–9 **London**
World Oil Prices
Details: Jenni Wilson, Centre for Global Energy Studies, UK
Tel: +44 (0) 171 235 4334
Fax: +44 (0) 171 235 4338

9–10 **Berlin**
Energy Markets, What's New?
Details: Prof Dr Georg Erdmann
Fax: +49 30 3142 69 08

9–10 **The Netherlands**
Shared Services: Achieving Cost Effectiveness and Service Excellence in the Energy Industry
Details: IQPC Ltd, UK
Tel: +44 (0)171 430 7300
Fax: +44 (0)171 430 7303

12–13 **Singapore**
8th Annual Pacific Petroleum Insiders Upstream
Details: Global Pacific & Partners (Pty) Ltd, US
Tel: +1 281 597 9578
Fax: +1 281 597 9589

13–18 **Houston**
17th Congress of the World Energy Council
Details: Barry Haest, WEC Congress Exhibition Director, Management PennWell Conference & Exhibitions, US
Tel: +1 713 963 6238
Fax: +1 713 963 6284

13–18 **Houston**
Energy and Technology: Sustaining World Development into the Next Millennium
Call for Papers: Mr Richard H Williamson, Houston World Energy Congress Inc, US
Tel: +1 202 331 0415
Fax: +1 202 331 0418

14–15 **London**
Fuel Cell Technology
Details: IQPC Ltd, UK
Tel: +44 (0)171 430 7300
Fax: +44 (0)171 430 7301

14–15 **Nicosia, Cyprus**
The Iranian Petroleum Summit
Details: Beth Scanlon, SMi Ltd, UK
Tel: +44 (0)171 252 2222
Fax: +44 (0)171 252 2272

14–16 **Bahrain**
Middle East Petrotech '98
Details: Arabian Exhibition Management WLL, Bahrain
Tel: +973 550033
Fax: +973 553288

14–16 **London**
Petroleum Economics
Details: IBC UK Conferences
Tel: +44 (00171 453 5491
Fax: +44 (0)171 636 6858

14–18 **Oxford**
LPG Supply, Economics, Markets and International Trading
Details: The College of Petroleum and Energy Studies, UK
Tel: +44 (0)1865 250521
Fax: +44 (0)1865 791474

17–18 **London**
Risk Analysis
Details: IBC UK Conferences
Tel: +44 (0)171 453 5491
Fax: +44 (0)171 636 6858
e-mail: cust.serv@ibcuk.co.uk

18 **London**
Clean Use of Fossil Fuels into the Millennium
Details: Dr T H Page, BP Oil, UK
Tel: +44 (0)1932 763141

18–21 **Surrey, UK**
Understanding the Commercial, Economic and Trading Aspects of Oil Refining
Details: Petroleum Economist, UK
Tel: +44 (0)171 831 5588
Fax: +44 (0)171 831 4567/5313

19–20 **Muscat, Oman**
Petroleum Trading and Cargo Shortages
Details: Mike England, Abacus International, UK
Tel: +44 (0) 1245 328340
Fax: +44 (0) 1245 323429

20–25 **Oxford**
The Commercial and Political Challenges
Details: The Alphatania Partnership, UK
Tel: +44 (0)171 613 0087
Fax: +44 (0)171 613 0094

21–24 **Oxford**
Commercial Issues in LPG Trading – Contracts, Shipping, Prices and Risk Management
Details: The College of Petroleum and Energy Studies, UK
Tel: +44 (0)1865 250521
Fax: +44 (0)1865 791474

21–25 **Scotland, UK**
UK Oil & Gas Law
Details: Ms Moira McKinlay, University of Dundee, Scotland, UK
Tel: +44 (0)1382 344303
Fax: +44 (0)1382 322578
e-mail: cplmp@dundee.ac.uk

23–24 **Dresden, Germany**
Gasification – The Gateway to a Cleaner Future
Details: Tracy Lepkowska, IChemE, UK
Tel: +44 (0)1788 578214
Fax: +44 (0)1788 577182

23–25 **Liguria, Italy**
Ports 98, Maritime Engineering and Ports
Details: Sally Radford, Wessex Institute of Technology, UK
Tel: +44 (0)1703 293223
Fax: +44 (0)1703 292853
e-mail: sradford@wessex.ac.uk

24-25 **Singapore**
Petroleum Trading and Cargo Shortages
Details: Mike England, Abacus International, UK
Tel: +44 (0)1245 328340
Fax: +44 (0)1245 323429

27–30 **New Orleans**
SPE Annual Technical Conference and Exhibition
Details: Dan Lipsher, Society of Petroleum Engineers, US
Tel: +1 972 952 9306

28-1 Oct **Oxford**
LPG Direct Marketing, Operations and Safety
Details: The College of Petroleum and Energy Studies, UK
Tel: +44 (0)1865 250521
Fax: +44 (0)1865 791474

29 **London**
Effective Visual Communication for Geoscientists
Details: The Administrative Secretary, JAPEC, UK
Tel: +44 (0)171 434 9944
Fax: +44 (0)171 439 8975

29–30 **Oslo**
Improving the Exploration Process by Learning from the Past
Details: Norwegian Petroleum Society, Norway
Tel: +47 22 12 90 08
Fax: +47 22 55 46 30

IP Conferences and Exhibitions

International Conference on

Recommissioning? Removing, Re-using or Recycling Redundant Offshore Facilities

The Netherlands: 14–15 October 1998

This international Conference, organised in association with the Netherlands Energy Research Foundation (ECN) and the IP Netherlands Branch, will focus on the practical and economic aspects of removing, re-using or recycling redundant offshore oil and gas production facilities and will give some actual examples of what has been achieved to date. These concepts are in line with the decisions announced following the agreements reached at the OSPAR meetings in Portugal in July 1998.

The two day programme covers a wide range of topics and includes two technical tours, an exhibition, poster displays and a Conference Dinner.

Who should attend?

- Contractors
- Senior Managers
- Environmental Managers
- Regulators
- Decommissioning Managers
- Facilities Engineers
- Design Engineers
- Health and Safety Specialists
- Consultants
- Environmentalists

The programme and registration form is now available.

Conference on

Microbially Enhanced Oil Recovery

London: 4 November 1998

The use of microbes to enhance oil recovery is a controversial subject that has been with us for many decades and is generating renewed but cautious interest within the oil industry. Proponents offer an inexpensive means to increase oil production and more recently an alternative to the use of biocides as a means of controlling H_2S generation.

This Conference will present the various issues associated with this technology. Speakers will present data of specific products - both whole cells and enzymes, means of testing their performance, and the view of the oil industry. The aim will be to assess the current and likely future role of MEOR in North sea oil production.

Who should attend?:

- Production Technologists and Chemists
- Reservoir Engineers
- Microbiologists
- Chemical Suppliers
- Environmental Managers

The programme and registration form is now available.

For programmes and registration forms please write or fax: Pauline Ashby, Conference Administrator, Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK Tel: +44 (0)171 467 7100 Fax: +44 (0)171 255 1472 e-mail: pashby@petroleum.co.uk

International Conference on

The Future of Transportation Fuel Quality in Europe

London: 12–13 November 1998

In recent months, there has been considerable debate and discussion within the Commission and Parliament of the European Union, the automotive industry and the oil industry, on the quality of transportation fuels required by 2005 to contribute to meeting European Air Quality Standards.

This major international Conference organised in association with the French Association of Petroleum Technicians and Professionals (AFTP) and the German Society for Petroleum and Coal Science and Technology (DGMK) will bring together representatives from the European Commission, UK Government, the oil and automotive industries, environmentalists and academia to present their views on current and future legislation, the inter-relation between automotive vehicles and fuels and their impact on the environment, and the implications for the European refining industry.

The programme and registration form is now available.

Autumn Luncheon

London: 30 November 1998

Guest of Honour and Principal Speaker:
His Excellency Sheikh Ahmed Zaki Yamani

Former Minister of Petroleum and Mineral Resources for Saudi Arabia, 1962–1986.

The Institute of Petroleum is launching its first annual Autumn Lunch in London on Monday 30 November 1998 with Guest of Honour and Principal Speaker, His Excellency Sheikh Ahmed Zaki Yamani, Former Minister of Petroleum and Mineral Resources for Saudi Arabia and Chairman of the Centre for Global Energy Studies.

We are confident that this Autumn Lunch will become an established date in the oil and gas calendar of events and will provide a unique opportunity to meet colleagues and to hear internationally renowned figures speak on the issues influencing our global industry today. It is expected therefore that many companies will purchase tables and maximise the opportunity to entertain guests at, what we hope, will become one of the key social events in the industry year.

The ticket application form is now available.

Next year

IP Week 1999

London: 15–18 February 1999

The ticket application form for the Annual Dinner will appear in the October issue of Petroleum Review. To avoid postal delays, non UK Members should apply now for an application form.

The full Programme for all events in IP Week 1999 will be available in October.

Diary Dates

Energy Economics Group

'Towards an Energy Policy?'

Wednesday 23 September 1998, noon–2.15

Martin O'Neill MP, Chairman, House of Commons Select Committee on Trade & Industry

This meeting includes a buffet lunch at a cost of £18. Prior registration is essential. Please apply for a form.

IP Contact: Jenny Sandrock

London Branch

'City Fuels'

Wednesday 14 October 1998, 17.15 for 18.00

Tamara Early, Managing Director, Greenergy UK Ltd and **Andrew Owens,** Managing Director, Greenergy International Ltd

Tea and biscuits will be serve at 17.15. Light refreshments will be available afterwards.

IP Contact: Mrs C Reader, Tel: +44 (0)181 852 9168

Energy Economics Group

'Key Energy Policy Issues'

Thursday 8 October 1998, 17.00 for 17.30–19.00

Anna Walker, Director General, Energy, Department of Trade & Industry

IP Contact: Jenny Sandrock

Energy Economics Group

'Emissions Trading: the Precedents, the Policies, and Likely Developments'

Thursday 22 October 1998, 17.00 for 17.30–19.00

Richard Ward, Executive Vice-President, International Petroleum Exchange

IP Contact: Jenny Sandrock

All meetings are held at the Institute of Petroleum unless otherwise stated. Please tell the IP contact if you plan to attend any of these free meetings. Tel: +44 (0)171 467 7100

Recruitment

MOVES People

Extensive changes have been made to the boards of BP and Amoco due to the recent announcement of the merger between the two companies (see page 9). The board of BP Amoco will comprise 13 directors from BP, of whom six will be executive directors, and nine directors from Amoco, of whom two will be executive directors. **Sir John Browne** will be CEO of BP Amoco. He will also be Chairman of the Management Committee and **Larry Fuller** Deputy Chairman. The two will co-chair the transition team responsible for integrating the operations of the new group. BP Deputy CEO **Rodney Chase** and Amoco President **Bill Lowrie** will be Deputy CEO's and Presidents of BP Amoco. Chase will have responsibility for exploration & production and Lowrie for refining & marketing, and chemicals. BP Chief Financial Officer **John Buchanan** will be CFO of the new company. As co-Chairman of the new group, Fuller will remain an Executive Director until his retirement in the first half of 2000.

Dr Eileen Marshall was appointed Deputy Director General of Ofgas with effect from 1 July 1998. Until then she had been Ofgas' Chief Economic Adviser and Director of Regulation and Business Affairs.

Robert Pirani, Vice-President of Kvaerner Process (UK) Ltd and responsible for business development and project execution for national and international pipeline projects has been elected National Chairman of the Pipeline Industries Guild for the year 1998–99. Pirani has been an active member of the Guild since 1981 and was Chairman of the Technical Development and Publication Committee.

Shell Bitumen has appointed **Alistair Martin** as Construction Industries Manager for Scotland with responsibility for sales of bitumen, oils and lubricants to the quarrying and construction related industries in Scotland. Martin joins Shell Bitumen from Tilcon where he was Sales & Marketing Director and Executive Director of Caledonian Quarry Products.

Sue Simms has been appointed Managing Director of Alliance Gas on the transfer of **John King** to Norway. She will report to **Thor O Lohne**, Manager Gas Division, Statoil (UK). King has been Managing Director of Alliance Gas since August 1996 and leaves to take up a management role in Statoil, Norway, within Natural Gas Marketing and Supply.

Kvaerner Shipbuilding has appointed **Olli Mäkelä** as Managing Director of the group's Russian shipyard, Kvaerner Vyborg Shipyard JSC.

Fina has appointed two additional managers to their Epsom-based Shop team. *Martin Kell* (top) joins Fina from Safeway, where he spent 13 years developing their shops including their forecourt outlets and *Laura Smith* (bottom) who has spent eight years as a Commercial and Marine Manager for Fina. Both positions will report to *Mark Stephenson,* head of Fina's shop development. They will be responsible for the overall offering from range, promotion, pricing, marketing and introduction of new products.

Don Argus has been appointed Chairman of Broken Hill Proprietary replacing **Jerry Ellis**. Argus joined BHP's board in August 1996.

Wood Group's Engineering & Operations Support division has appointed **Graham Good** as Group Company Secretary and **Nick Brown** to the new position of Commercial/Contracts Director.

Ingersoll-Dresser Pump Company has named **Charles L Griffith Jr** as President and Chief Executive Officer. Griffith joins the company from Fram/Autolite Corporation, a unit of Morris Township. He succeeds **Frederick W Hadfield**, who is retiring after 33 years service.

The Expro Group has appointed *Michael Macdonald* as Sales Co-ordinator for its consultant drilling, engineering and supervisory personnel brand, Ecodrill. Macdonald, who has been with the Group for three years, was previously Drilling Services Co-ordinator and responsible for determining clients' short- and long-term requirements.

Jim Scott has been appointed Operations Manager at Andrews Hydrographics Offshore Survey Division in Aberdeen. He will be responsible for day-to-day operations including rig moves, swathe bathymetry, pipeline and cable route surveys. He joins the company from OSAE (UK).

John Houston has retired as Chairman of Water Management Consultants. He founded the company in 1990 and served as CEO until 1997 when he assumed position of Chairman upon the appointment of **Jerry Rowe** as the company's CEO.

Econosto Flow and Sealing Technology Division has appointed two additional sales people. *Graham Turner,* (right) who will be based at the company's Cleckheaton head office will take over the Northern Area as Sales and Marketing Manager for sealing materials and gasket products. *Danny Sills* (left) has been employed as Contracts Manager with specific focus for valve sales.

Marlan T Boultinghouse, President of Arco Aluminium Inc for the past 16 years has died after battling with a rare blood disease. Boultinghouse served as President of the wholly owned Arco subsidiary since 1982 following a lengthy career with The Anaconda Company which merged with Arco in 1977. **Mark C Durst** has been appointed his successor. Prior to this Durst was Vice-President of Materials and Human Resources for Arco Aluminium.

IP THE INSTITUTE OF PETROLEUM

API 1581 – Meeting the needs for the 21st century

The current internationally adopted specification for the design and performance of filter water separators used to decontaminate jet fuel at airports world-wide has remained essentially unchanged for at least two decades during which the fuel itself and fuelling operations have changed dramatically.

In 1999, API will produce a 4th Edition of this specification which will seek to address many of the improvements which the industry has requested whether from the equipment user or customer points of view.

Specifically, coalescer disarming and particulate removal are being addressed following extensive research into what exists in the field and what end-users expect in terms of fuel quality. The proposed new document which will become a 'Standard' will also include requirements for military equivalents. It will be a significantly different document from the previous editions.

An international conference 'Aviation 2000 – Safety and Operations' co-organised by the IP and API in London in October will discuss the revised standard and address how the industry will manage the change from mid-20th century technology to more versatile 21st-century options.

International Conference and Exhibition on

Aviation 2000 – Safety and Operations

held in association with the American Petroleum Institute

American Petroleum Institute

London: 1–2 October 1998

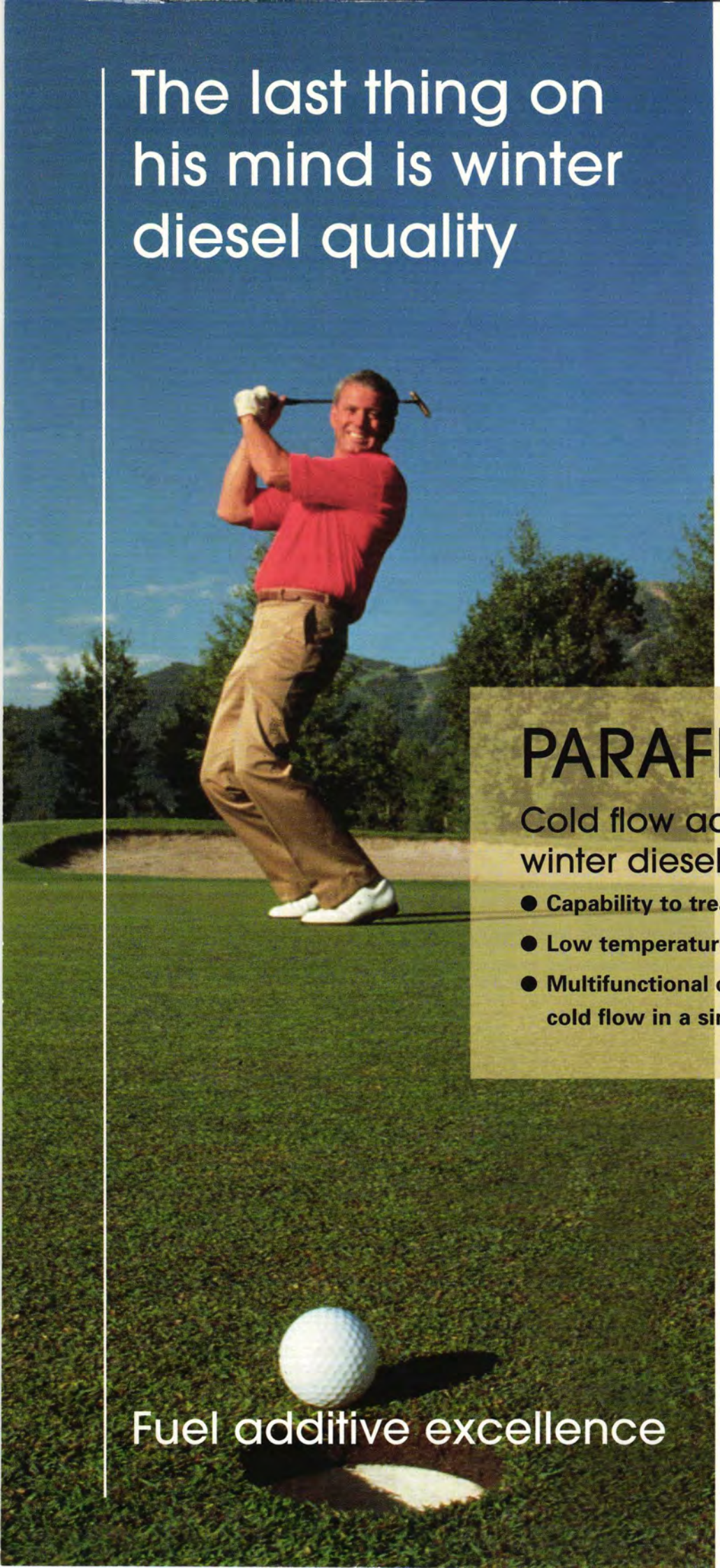
This will be the third in the series of IP Aviation Conferences and Exhibitions co-organised by the Institute of Petroleum (IP) and the American Petroleum Institute (API). This year's Conference and Exhibition will be held in London from 1–2 October and will address the key issues relevant to the industry as it approaches the new millennium:

- Ramp Safety
- The IP/API Airports Code
- Year 2000 and Embedded Systems
- Aviation Fuel Composition and its Impact on Engine Performance
- AP1 1581 – Progress and Status
- New Developments in Filtration and Related Test Procedures.

An exhibition of equipment linked with aviation fuelling will also be held in association with the Conference. Exhibitors to date include: **Alfons Haar, Elaflex, Faudi Filtersystem, Fuelling Components, GEC Marconi Aerospace, Hansa Consult, Scully UK, Stanhope Seta and Warner Lewis.**

For a copy of the programme and registration form, or for details on exhibiting, please contact: Pauline Ashby, Conference Administrator, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK. Tel: +44 (0)171 467 7100 Fax: +44 (0)171 255 1472 e-mail: pashby@petroleum.co.uk

or view the programme on the IP web page **www.petroleum.co.uk**



The last thing on his mind is winter diesel quality

We aim to keep it that way

When things are running smoothly, it can be difficult to focus on winter preparations. But, to maintain reliable diesel fuel quality and meet winter specifications, now is the time to plan your cold flow additive requirements.

Your customers rely on keeping moving whatever the weather. They look for fuels that they can trust – high quality fuels that can survive in the coldest conditions. Producing a winter diesel fuel that will not let them down demands superior additive technology. Paramins™ expertise and commitment to R&D have produced a range of high quality cold flow products.

PARAFLOW™

Cold flow additives for winter diesel

- **Capability to treat different fuel types**
- **Low temperature operability additives**
- **Multifunctional capability – lubricity and cold flow in a single additive**

Contact your Paramins™ representative to find out more about Paraflow™ cold flow additives. For a reminder of the quality of diesel fuel last winter please call Rose Gill on (+44) 1235 545721 for a copy of our Worldwide Winter Diesel Survey

PARAMINS

EXXON CHEMICAL LIMITED
Paramins Marketing Communications
P.O. Box 255, Abingdon,
Oxfordshire OX13 6TT
Tel. 01235 545701 - Fax 01235 545715

Fuel additive excellence