

+ **6 BOARD TALK**
BP chairman in conversation

46 VIKING AGE
BP exhibition opens at British Museum

64 IN THE BAG
Supporting South African school kids



THE INTERNATIONAL MAGAZINE OF THE BP GROUP

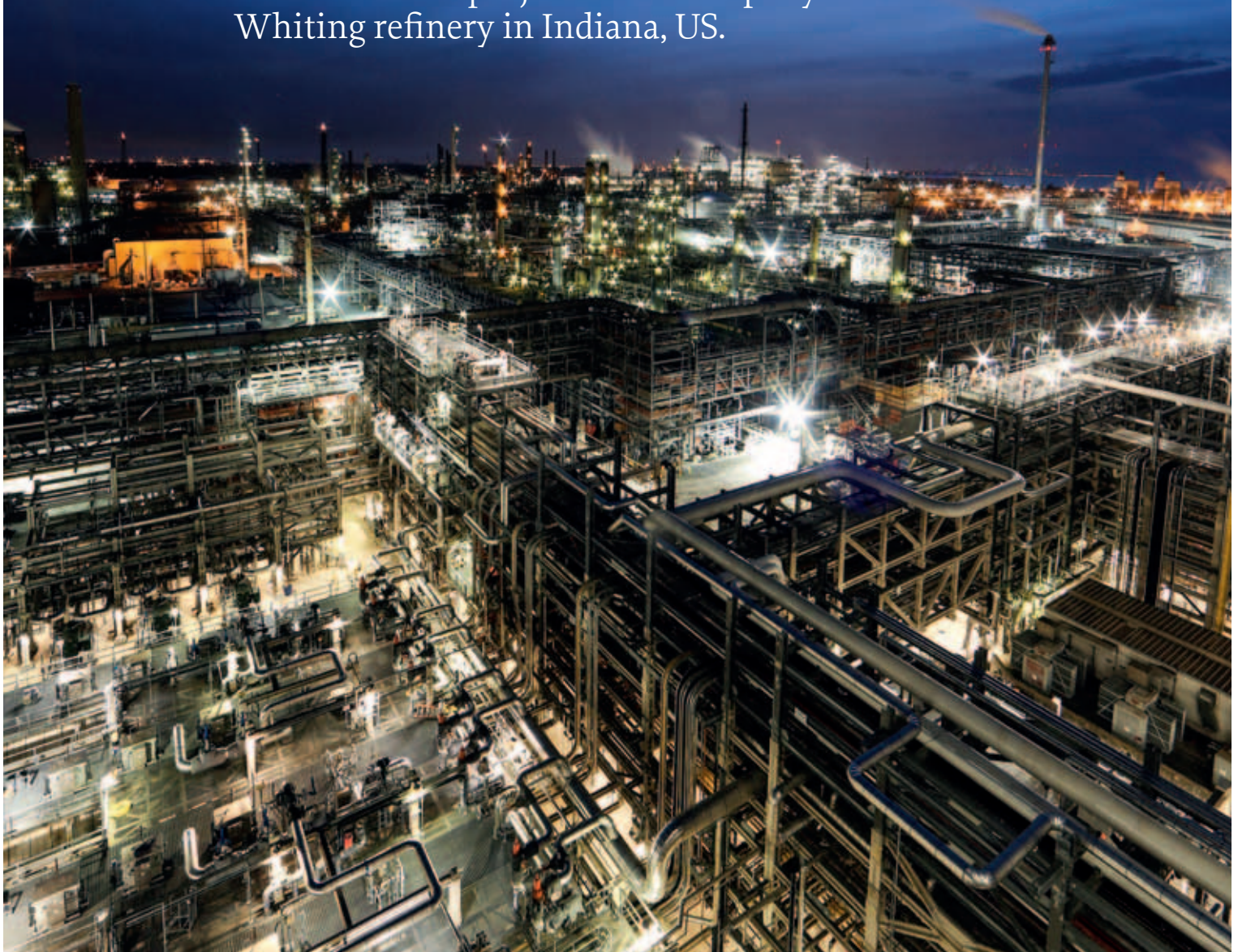
ISSUE 1 2014

BP MAGAZINE

26 **SPOTLIGHT:** WHITING REFINERY

A NEW ERA

BP Magazine reports on the scale of the major modernisation project at the company's Whiting refinery in Indiana, US.



Welcome. It's been a busy start to the year for BP, with three major Upstream projects starting up – Na Kika and Mars B in the Gulf of Mexico and the Chirag Oil Project in Azerbaijan (page 5). More are due onstream later in the year. The end of 2013 was also eventful, with the approval of two strategic long-term investments – Azerbaijan's Shah Deniz 2 development (page 12) and Oman's Khazzan gas field (page 14), along with the completion of commissioning of the major new units for the Whiting Refinery Modernisation Project (page 26). On page 6 BP's chairman Carl-Henric Svanberg discusses the role of the board in a multinational organisation and why he believes challenging times can act as a catalyst for positive change. Elsewhere in the magazine, we visit the British Museum to find out more about its new BP exhibition *Vikings: life and legend* (page 46) and we head to South Africa to find out about a project to turn old advertising hoarding materials into bags and pencil cases for disadvantaged school children (page 64).

Lisa Davison > Editor

BP MAGAZINE

The international magazine of the BP Group – ISSUE 1 2014

BP Magazine is published quarterly for external readers around the world, as well as past and present BP employees. Its content does not necessarily reflect official company views.

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Cover image: A dusk view of BP's Whiting refinery, Indiana, US.
Photograph by Joshua Drake

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64



46 Gold standard

BP Magazine visits the British Museum in London where the Vikings have landed for the first time in more than 30 years.



For the record

Highlights from around the globe > Spring 2014

the quarter in numbers

3.2%

The rise in BP's underlying production rate in 2013 versus 2012 (excluding Russia).

7

Number of potentially commercial discoveries in which BP participated in 2013.

95.3%

BP's Downstream refinery availability during 2013. This number reflects efficiency at the company's operated sites.

\$13.4 billion

BP's underlying replacement cost profit for 2013 (after tax). This compares with \$17.1 billion for 2012 and was affected by the significant impact of BP's major divestment programme; weaker refining margins; and higher depreciation and exploration write-offs as the group brought new projects online and increased its investment in exploration.



US: LOWER 48 ONSHORE BUSINESS ANNOUNCED

BP is to establish a separate business to manage its onshore oil and gas assets in the US Lower 48 (US states excluding Alaska and Hawaii). The move will help the new organisation adapt to the rapidly changing and hyper-competitive energy landscape in the region. It is expected to help unlock significant value associated with BP's

extensive resource position. Although wholly-owned by BP, the business will be led by a separate management team. It will have separate governance, processes and systems designed to address the unique competitive and operating environment in the US Lower 48 onshore. "Over the past few years, we have fundamentally reshaped our North

America Gas portfolio," said BP Upstream chief executive Lamar McKay. BP has done so by divesting non-core assets and focusing development on leading US unconventional plays, such as the Eagle Ford Shale in South Texas. "Now, it's time to reshape the way we run the business – and we are very excited about this bold step forward."



NEWS IN BRIEF

US

EPA agreement

BP has entered into an administrative agreement with the US Environmental Protection Agency (EPA), on behalf of the federal government, resolving all matters related to the suspension, debarment and statutory disqualification of BP following the Deepwater Horizon accident and oil spill. As a result of this agreement, BP is once again eligible to enter into new contracts with the US Government, including new deepwater leases in the Gulf of Mexico (GoM). "After a lengthy negotiation, BP is pleased to have reached this resolution, which we believe to be fair and reasonable," said John Mingé, chairman and president of BP America. For more information, visit the 'www.thestateofthegulf.com BP sets the record straight' website.



US

Na Kika start-up

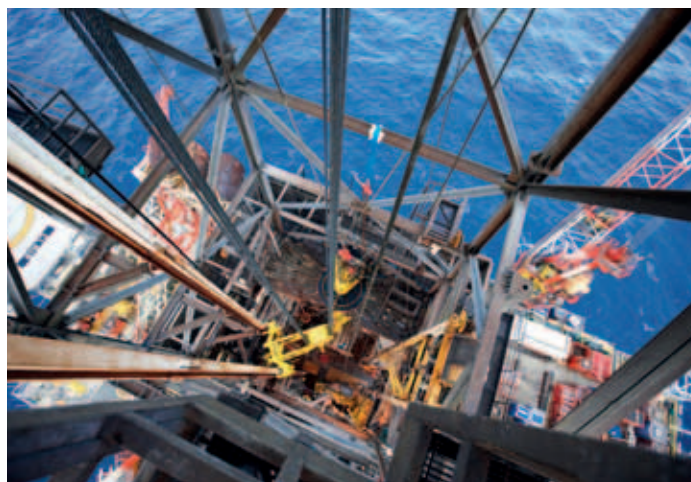
Phase 3 of BP's Na Kika development in the deepwater GoM, started up in February. The project supports BP's

strategy to grow high-margin production at four BP-operated hubs in the deepwater GoM. A second well is expected to begin producing in the second quarter of 2014. The Phase 3 project includes the drilling and completion of the two new wells, the addition of subsea infrastructure to tie-back to the Na Kika platform (below left) and new equipment to allow increased production from an existing well at the site. It is BP's third new major upstream project to begin production so far in 2014, following the Chirag Oil Project in Azerbaijan and the Mars B project, also in the GoM. BP expects to start up more projects during the rest of 2014.

Global

Outlook published

Global energy demand continues to grow, but is slowing and mainly driven by emerging economies – led by China and India – according to the *BP Energy Outlook 2035*. It is the fourth annual edition of the report and, for the first time, it sets out BP's view of the most likely developments in global energy markets farther beyond 2030 to 2035, based on up-to-date analysis. It reveals that global energy consumption is expected to rise by 41% from 2012 to 2035 – compared to 55% over the past 23 years and 30% over the past 10. Ninety-five percent of that growth in demand is expected to come from the emerging economies, while energy use in the advanced economies of North America, Europe and Asia as a group is expected to grow only very slowly – and begin to decline in the later years of the forecast period. For more information, visit www.bp.com/energyoutlook



Global

Industry award

For the second time in four years, BP is the recipient of the Offshore Technology Conference (OTC) distinguished achievement award – this time for its deployment of the *LoSal*® EOR system in the Clair Ridge development, located west of Shetland, UK (above). *LoSal* EOR reduces the salinity of water used to flood reservoirs, which leads to increased oil recovery. BP will be recognised as the award winner in the corporate achievement category at the annual OTC in May. The company last won the award in 2011 for its Life of Field Seismic reservoir surveillance project.

Azerbaijan

Oil production starts

The Azerbaijan International Operating Company (AIOC), operated by BP, has begun oil production from the West Chirag platform as part of the Azeri-Chirag-Gunashli (ACG) field development in the Azerbaijan sector of the Caspian Sea. The oil will first pass through the newly-installed processing facilities on the platform and, then, will

be exported to the Sangachal terminal via a new infield pipeline linked to an existing 76-centimetre (30-inch) subsea export pipeline.

UAE

Technology collaboration

Masdar Institute of Science and Technology, an independent, research-driven, graduate-level university focused on advanced energy and sustainable technologies, has signed a multi-year technology innovation collaboration agreement with BP in support of innovation and entrepreneurship in the United Arab Emirates. According to the agreement, Masdar Institute and BP will jointly contribute \$7 million over six years in Masdar Institute-based innovation and entrepreneurship programmes.

US

Oil discovery

BP has made a significant oil discovery at its Gila prospect, which it co-owns with ConocoPhillips, in the deepwater US GoM. This is BP's third discovery in recent years in the emerging Paleogene trend in the GoM, following Kaskida in 2006 and Tiber in 2009.



→ interview

WITH
BP'S CHAIRMAN

FORWARD FOCUS

Since he became BP chairman four years ago, Carl-Henric Svanberg has seen the company face some of its toughest challenges. But, as he explains to *BP Magazine*, he is a firm believer in using difficult experiences as a catalyst for change, starting with the BP board.

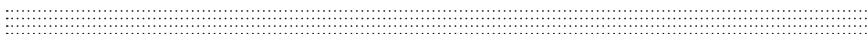


REPORT > MARTIN VANDER WEYER

PHOTOGRAPHY > GRAHAM TROTT



A generation ago, the task of a non-executive chairman of a great public company was widely seen as important but limited in scope: principally, to preside over the board, run the Annual General Meeting (AGM), appoint directors and – when asked – to offer quiet advice to the chief executive. But times change, and for Carl-Henric Svanberg, chairman of BP since 1 January 2010, the job was different and demanding right from the start.





The Macondo accident in the Gulf of Mexico occurred less than a week after his first AGM in April 2010. Svanberg and then chief executive Tony Hayward were thrust into the global media spotlight, and the company was in crisis for several months. Now, looking back after four years, what lessons does Svanberg draw for the future of BP, the role of its board, and his as chairman?

“The accident in the Gulf of Mexico was tragic; we must never forget the 11 people who lost their lives. It should never have happened. However, when a company goes through such a defining event, the experience often becomes a catalyst for change on many different levels. I believe we rose to that challenge: management and the board came together as a team to steer the company through this extremely difficult time. It made us turn over every stone and think about what we wanted BP to be. Because of that process, the board’s role has also changed and grown.

“Bob Dudley as CEO and his executive team are fully responsible for running the company – Bob and I have a great working relationship. But, what has evolved is the board’s closer involvement in debating issues with him and his team. Remember that eight of our 11 non-executive members are effectively new since the Deepwater Horizon accident – that includes three of us who joined very shortly before the accident. Our board today has more experience in oil and gas and other major industries than most of its predecessors. I believe that we’re now even better equipped to support and to challenge the executive team.”

As well as working with the board, Svanberg has also supported Dudley in changing the way in which the entire group works. “BP had been an asset-based organisation since its beginnings,” he

observes. “The North Sea, Azerbaijan, Angola – each region ran its own business, which could lead to local differences. Now, we have global structures; one organisation for exploration, one for drilling, one for production, and so on. That means we have taken an important further step in the standardisation of our work processes and procedures, with the aim and advantage of being more systematic in how we exchange expertise and lessons learned between sites.

“Bob’s strategy has been to address safety, to rebuild trust in the company, and to focus on creating value. Those are the big objectives. As for the aftermath of the accident and the ongoing litigation – as I travel around the world, what has struck me is how many people are impressed by the way we stood up as a company and said, ‘We’re going to clean this up and we’re going to pay those who have a legitimate claim. However, we’re not going to accept being taken advantage of. We are committed to doing what’s right and to be an example.’

“However, to successfully drive change throughout a company takes time. You not only have to preach it, but you have to live it and really make sure that the desired behaviours get into the bloodstream of the company. I’ve visited BP sites in Azerbaijan, Angola, China, Australia, the North Sea, Alaska, and several times in the Gulf of Mexico, as well as our refinery in Whiting [see page 26 for more on BP’s Whiting refinery]. Those trips are some of the best parts of my work and I look forward to more of them in the near future. Wherever I go, I have been asked to hold townhall meetings with our employees to discuss what the board does, and how we want the company to move forward, and it gives me valuable opportunities to meet so many of our great people. It’s also on these trips that I can see

whether these changes are really taking root. A visit provides invaluable insights, and I am pleased that other board members have also made visits to different sites.”

Being a former chief executive – for seven years at the telecoms group Ericsson in his native Sweden, and before that for eight years at Assa Abloy, the world’s biggest lock maker – clearly shapes Svanberg’s style of chairmanship. “It would have been more difficult to do my job here if I hadn’t been a CEO,” he says. As for the make-up of the board, “You have to create a group that’s dynamic and experienced. Other chairmen may have different views, but I think it’s vital to have several board members who are former CEOs or senior executives, mixed with experts from different fields.

“In today’s online and immediate world, CEOs, in some ways, become a public commodity. You’re exposed to the media and shareholders, some of whom may be active or even activist. You may face hostile takeovers. And you have to learn how long it takes to bring change to a big organisation. The board has to understand all of this, too, and that’s why I think having »

“Other chairmen may have different views, but I think it’s vital to have several board members who are former CEOs or senior executives mixed with experts from different fields.”



a majority of people who have run other businesses is critical. We're lucky to have great people from several companies, such as BHP Billiton, United Technologies, Unilever, and McKinsey, as well as an admiral from the US nuclear navy and the head of University of Cambridge's engineering department.

"Everyone on our board brings real experience. They can say, 'I've seen this happening elsewhere; these are early indicators that we should watch for,' or 'This is a new technology we should really look at.' That really adds value in the boardroom. But, we are non-executive directors and must always remember our role in supporting and challenging the management team."

Since 2012, Svanberg has also had a second job as chairman of AB Volvo, the leading global truck maker, based in

Sweden. How does he manage to juggle two chairmanships, in different countries?

"I would turn that question around," he responds easily. "Not many chairmen have as few business positions as I do: BP and Volvo. Twenty years ago, you could find people who sat on five or six boards – but not anymore, because each one is so much more demanding, and I want to be able to really focus on what I have been asked to do. I'm expected to spend around two to three days a week with BP. I'm doing that and probably more. In Scandinavia, the board is not quite as involved, so I usually spend half as much time with Volvo. That means some 150 working days, which gives me room to be available for all of the unexpected challenges that can and do arise."

After a Master's degree in applied physics, Svanberg built his career with the

“Twenty years ago you could find people who sat on five or six boards – but not anymore, because each one is so much more demanding, and I want to be able to really focus on what I have been asked to do.”



Swedish-Swiss engineering group ABB, before moving to run Stockholm-based Assa Abloy, and then Ericsson. Does that history, plus the Volvo connection, mean he brings something distinctively Swedish to BP?

“I think you’ll find Swedish executives typically like getting out into the field, meeting people and seeing the realities. That’s part of the way we are. But more importantly, Sweden has a disproportionate number of global companies for the size of the country, be it Ericsson, Electrolux, Volvo, or SKF – and, typically, those companies only have 3-4% of their sales in their Swedish home market. But it’s not our role to teach the rest of the world the Swedish way. On the contrary, I believe we come to other countries with openness to learn about their history, culture and ways of thinking.”

As for BP’s balancing act in London – a global business run by an American, chaired by a Swede, but still largely regarded by investors as a British ‘blue-chip’ – Svanberg sees this as inspiring and positive for the company.

“We have every reason to be proud of our British heritage. The British have never been nervous about exploring and doing business around the world. This is a clear strength for BP. Though Britain may have lost some of its industrial footprint, it has become the centre for many international chairmen and directors today. But I also believe that London is a great place to be and to work from.

“Of course, there are differences I’ve had to learn about. In most European countries there’s more protection for companies through shareholding structures that encourage stable, long-term ownership, by different voting rights and other ways. Britain no longer has that, which means companies here are more directly exposed to investors. If they’re British pension funds

and don’t like what they see us doing, they will be quite vocal about it because BP is such an important component of the index.

“There are differences in the way our shareholders view ownership of the company. American investors are more likely to leave if they do not like what they see. In the UK, we get a more intense debate – but it keeps us on our toes. Yes, there’s always a tension between any company’s long-term strategy and shareholders who might seek quicker results. We need to listen to them very carefully. Shareholder pressure may not always feel positive, especially if it doesn’t feel warranted, but in the long run, it is a helpful challenge.

“Also, the press here is probably more influential, but we have to remember that they’re neither friend nor enemy. They just have a job to do. You may read an article one day that you’re upset about, but you just have to develop a thicker skin. And, I do believe that, over time, the real story always gets through.”

Svanberg himself has attracted media attention for his interest in environmental issues – he’s a member of the advisory board of the Earth Institute at Columbia University in New York. Since his Ericsson days, he has had an enthusiasm for using technology as a way to build a more intelligent society to reduce energy consumption. Its sounds like it could be a potentially uncomfortable debate for an oil company chairman, but he sees no conflict in this. The world’s GDP is likely to triple until 2050 and energy demand could almost double. In this world, all forms of energy are needed, as well as a strong focus on energy efficiency.

It’s quite clear to Svanberg what BP’s role in it should be: “Our task is not to take positions on climate change. We leave this to our political leaders and scientists. What we can bring to the discussion is knowledge

about what we see happening in the energy market and how the consumption of different forms of energy is likely to develop over time. As a global energy company, this is an area where we can add value. It’s important to get the facts right.”

Finally, conversation turns to another aspect of societal interaction – BP’s role in London as a major sponsor of exhibitions, notably in a long-running partnership with the British Museum. When he first arrived at BP headquarters, Svanberg was surprised to find a global energy business so engaged with the arts, “but I’ve come to appreciate how important this is, particularly for London and the UK. I also believe that every large company needs to play its part as a good corporate citizen. Our sponsorship programme plays a big part in our profile in London, and we’ve helped showcase some wonderful things. The *Shakespeare: staging the world* show was fantastic; I learned so much from it. And we have an exhibition about the Vikings coming up this year.” (see page 46 for more on the *Vikings: life and legend* exhibition).

This is especially exciting for Svanberg. “All those Viking voyages, rowing across the oceans and down rivers really took a lot of courage. I told a story at the museum last year, when we announced the exhibition: that the Norwegian Vikings went to Iceland and America, the Danish Vikings were the ones who came to Britain – and they were all great fighters. But, the Swedish Vikings went up the rivers into Russia and down the rivers to Constantinople, as it was then, now Istanbul. And, when you go by river, you know you have to come back the same way: if you make trouble on the way down, you should expect trouble on the way back. So, they had to build good relationships wherever they went. I hope that tells you something about Swedes and how we’ve come to see the world and our place in it.” ■

MAPPING THE SOUTHERN CORRIDOR

In December 2013, the Shah Deniz Consortium, of which BP is operator, announced the final investment decision for the Stage 2 development of the Shah Deniz field in the Caspian Sea, Azerbaijan. This decision triggered plans to expand the South Caucasus Pipeline through Azerbaijan and Georgia, to construct the Trans-Anatolian Gas Pipeline (TANAP) across Turkey, and to construct the Trans-Adriatic Pipeline (TAP) across Greece, Albania and into Italy, helping to create a new Southern Gas Corridor to Europe, as seen in this map.



SHAH DENIZ 2 AND THE SOUTHERN GAS CORRIDOR PIPELINES IN NUMBERS

3

Number of pipelines that will be joined together to get the gas from Azerbaijan to Italy

7

Number of sovereign countries the pipeline will directly benefit – Azerbaijan, Georgia, Turkey, Greece, Albania, Bulgaria and Italy

+30,000

Number of new jobs created over the next five years. This includes around 10,000 local construction jobs in Azerbaijan

26

Number of subsea production wells to be drilled for the project. Five have already been completed



3,500

Number of kilometres the buried pipeline traverses – almost the distance between New York and Los Angeles

16 billion

Amount of cubic metres of gas per year to be sold to market

20 x 7

Size in square kilometres of the Shah Deniz reservoir – the size of Manhattan Island

Look out for our special report from Turkey in *BP Magazine* Issue 2 2014, looking in more detail at BP's businesses in the region and the impact this investment decision will have on the country.

BP in Oman: (left to right from top) testing the ground for foundations at the future Khazzan compressor station site; Qurum beach in Muscat; Khazzan appraisal LR-5 drilling rig; Raqiba Al Tobi, a subsurface geologist on the Khazzan team; young technicians train at the technicians' centre launched by BP; vibrator trucks parked in the Omani desert during seismic operations in 2008; work at the future Khazzan compressor station site.

UNLOCKING POTENTIAL

Five years after BP drilled its first appraisal well in the Khazzan gas field, the company and the Sultanate of Oman find themselves on the cusp of one of the largest new projects in the Middle East, with the potential to become a major new source of gas for decades to come.

REPORT> SUAD SHAMMA PHOTOGRAPHY> MEHMET BINAY





Five years after BP drilled its first appraisal well to test the opportunity to produce a major new gas resource for Oman, the Sultanate now finds itself on the cusp of one of the biggest new projects in the Middle East. The Khazzan project involves investment of \$16 billion over a period spanning more than 30 years to unlock around 7 trillion cubic feet of gas and deliver a volume equivalent to around a third of Oman's current total daily domestic gas supply. More than that, it represents the first phase in the development of one of the Middle East region's largest unconventional 'tight gas' accumulations, which has the potential to be a major new source of gas supply for Oman over many decades.

Every major development faces technical challenges and risks, but these have been solved to a large extent through an extensive and rigorous appraisal programme for Khazzan. Step one: complete BP's largest-ever (at the time) onshore 3D seismic survey, covering an area the size of Greater London. Step two: continually improve drilling techniques using vertical and horizontal wells and hydraulic fracturing to unlock tight gas in hot, tight sandstone reservoirs located almost five kilometres (three miles) below the Earth's surface. Step three: prove the approach works through an extended well



test, exporting gas production from four wells to the national supply grid.

BP has accomplished all of these, giving the company and the Government of the Sultanate of Oman the confidence to approve the project at the end of 2013.

The signing of the agreement in December was a significant milestone for BP. Dave Campbell, general manager and vice president of operations for BP Oman, says: “We are getting into action on what we need to do in Muscat and in the field. We are also mobilising people from other parts of the world to help us safely deliver the project, and we have been working with the government and our partner, the Oman Oil Company for Exploration and Production, to place major contracts for the project.”

Significant opportunities

According to Khalid Al Kindi, BP Oman deputy general manager and in-country value manager, the Khazzan project provides three significant opportunities: “First is the energy required for economic development. The Sultanate of Oman has ambitious plans to attract investment into refining and petrochemical investments, including at a new industrial area in Duqm and at the established industrial hub of Sohar, where they will begin to produce more steel, aluminum, and other resources. All these projects have one thing in common – the requirement of energy. The second opportunity relates to what the

On site: (left) preparations being made at a hydraulic well stimulation site at Khazzan; (above) members of the Khazzan early well test compressor station operations team.

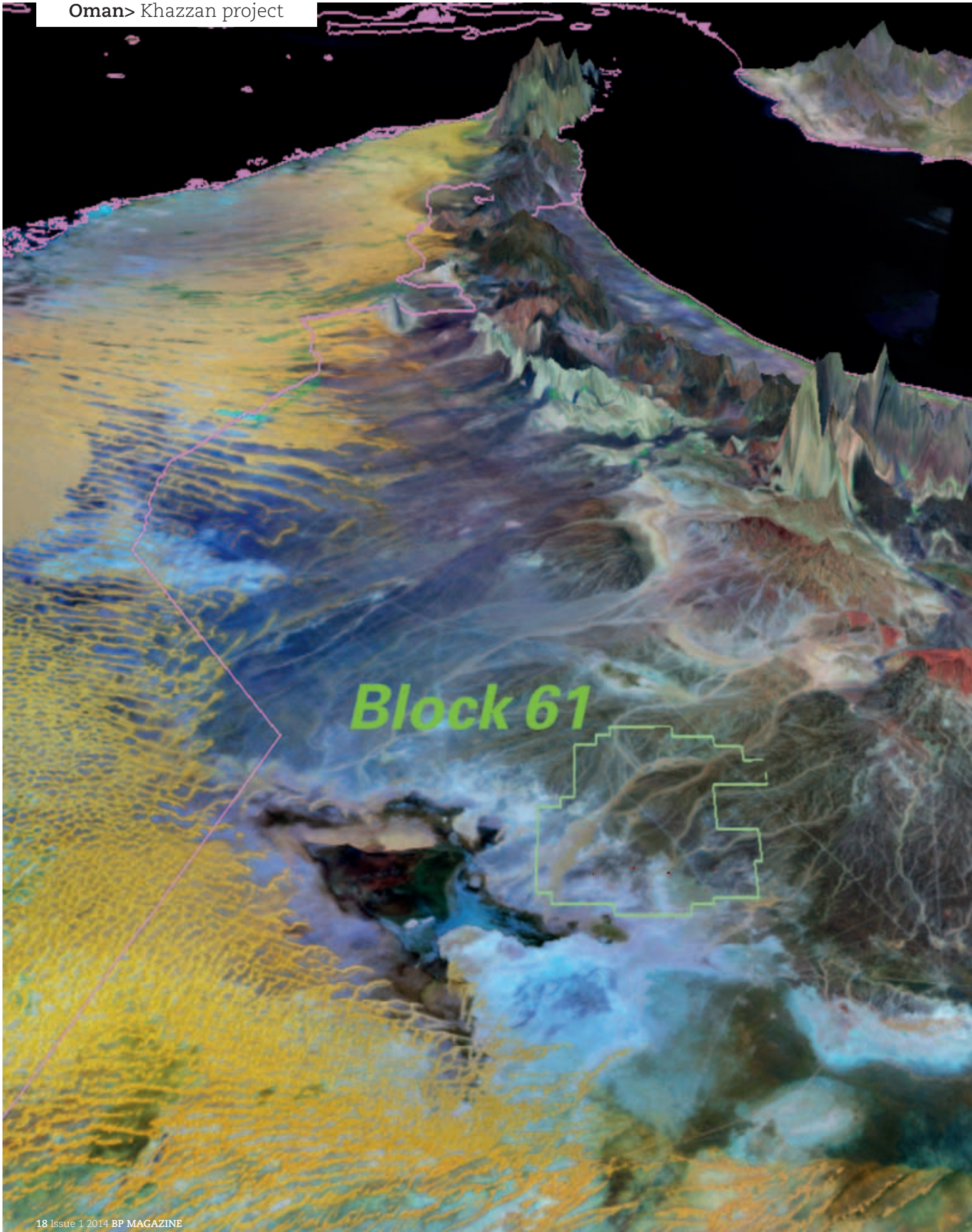
Government of the Sultanate of Oman calls ‘in-country value’ (ICV) – maximising the opportunities for local Omani companies in our supply chain. The third element is the development of Omani capabilities through the various programmes to invest in the people of Oman.”

According to the United Nations Development Programme, the Sultanate of Oman is one of the most improved countries in the world over the past 40 years in terms of education, healthcare and infrastructure. However, economic activity tends to be concentrated in Muscat and the northeast Batinah region. Significant challenges lie ahead, with rapid population growth creating a need to diversify the economy, grow the private sector, and create jobs for the thousands of young people leaving school each year. The oil sector plays a dominant role in the economy.

As I get on the BP bus at dawn that will transport me to the Khazzan field (a safety measure brought in by BP to reduce risks on the road), I have time to sit and reflect on these achievements from a nation that numbers just three million. Six hours, in fact, because Khazzan is located around 350 kilometres (220 miles) into the interior of Oman, in a concession area known as Block 61. To begin with, the journey takes you along perfect road from Muscat, past the ancient trading city of Nizwa, away from the mountains and into the hot, dry and endlessly flat desert. Closer to the

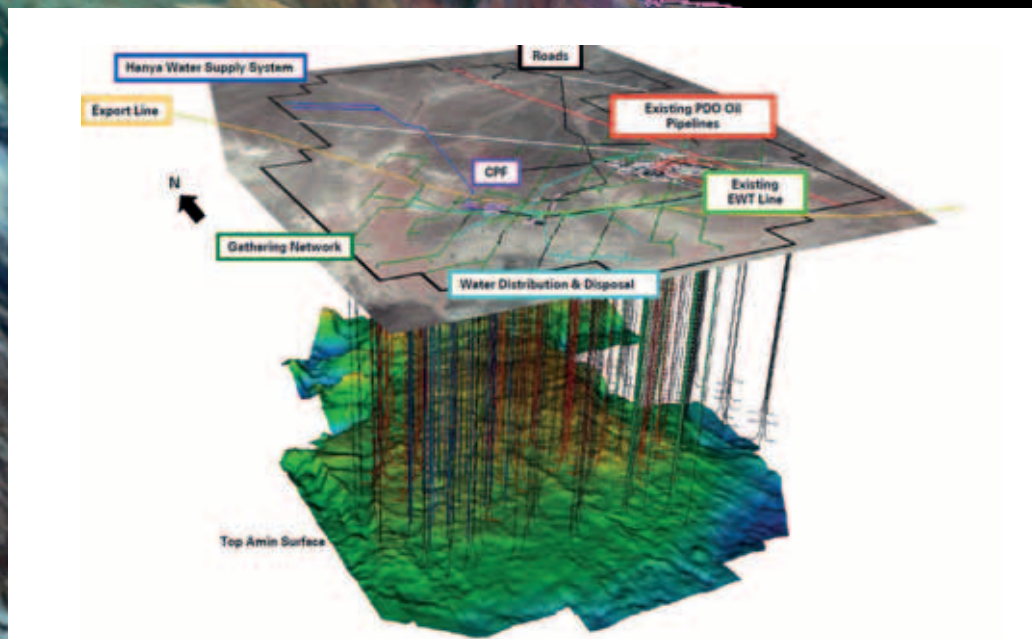
“We are getting into action on what we need to do in Muscat and in the field. We are also mobilising people from other parts of the world to help us safely deliver the project.”

Dave Campbell



Block 61

Muscat



This main photograph shows a satellite image of northern Oman superimposed on a topographical map, demonstrating the distance between the capital city Muscat and the Block 61 development, as well as giving an idea of the landscape. The inset photograph shows the surface of Block 61, along with seismic imaging of the top of the Amin reservoir – one of four reservoirs in BP's Block 61 concession (from the top down: Barik, Miqrat, Amin and Buah). Phase one of the Khazzan project will see BP develop the Barik and Amin reservoirs. The lines between the surface and reservoir represent the development wells BP intends to drill.



Local team: (above) young technicians at work at the technicians' centre. BP has hired 40 technicians on to the programme, so far, and has sent the first group of technicians for an overseas training assignment at other BP locations in the US and the UK; (below) preparation work at the future Khazzan compressor station; (left) young engineers review data.



block, we move onto graded gravel roads. The speed slows down and the temperature gradually rises, as we reach our destination at noon.

The first thing I notice upon arrival is the spirit of the people and the buzz about the place. BP Oman's people have always been lively and busy, but you can feel a significant change in the atmosphere – a mood of confidence and determination. The Khazzan project is now a definite part of the future, as an energy source for the country, helping to drive industrial growth, business and job opportunities.

Development programmes

Some of that impact is direct and already visible. For example, through the hiring and development of national staff. More than 70% of BP's workforce is Omani and the company is aiming to increase the level of 'Omanisation' in the coming years. To achieve this goal, BP has set up a series of development programmes.

In 2010, the company introduced its global graduate recruitment initiative, known as Challenge, which provides a structured three-year programme that includes potential for overseas training and development.

"We have recruited more than 30 Omani graduates so far and we intend to build our local workforce through continued recruitment over the coming years," says Stuart Worker, BP's head of human resources in Oman.

Raqiba Al Tobi, a geologist Challenger in the subsurface team in Oman, says of her experience: "As a female, I am proud that I am here. I am the only female geologist in the team. It gives me a chance to test myself to the limit and see what I'm capable of."

Many of the graduates who have secured a place on the programme are looking forward to more challenges in their careers. Abbas Al Lawati, a drilling engineer Challenger in BP Oman, says that there are many opportunities available. "I chose to work with BP because it is an international company. I saw a big opportunity for me to move around the world and experience how other operations work. Not many companies can provide these opportunities in Oman. BP offers worldwide expertise because of the diversity that exists in the organisation. Omanis are the future for BP Oman. BP has an excellent programme to develop our technical and leadership skills and to prepare us for greater responsibilities in the

future. I see a bright future for BP in Oman, where competent Omani leaders will help guide the company to success."

BP has also launched a technicians development programme – a structured five-year programme designed to take diploma graduates from technical colleges from foundation level to world-class technicians over a five-year period. The programme is expected to help more than 120 Omanis develop their skills.

Located in the industrial area of Muscat, the newly-established technicians' centre is a hive of student activity. Its main hall leads to the student-filled cafeteria, with more halls beyond that lined with classrooms, equipment and tools.

Abeer El-Beloushi, the first female to join the programme and only one of two women, says: "I am the only female here, so, naturally, I face challenges. However, some of the activities that I used to find difficult are now easy and I do them with efficiency. With teamwork and courage, I was able to get through all challenges. Nothing is impossible, you can do whatever you set your mind to. Nothing is too difficult for a woman, and I encourage females to enroll in this programme. Being the only female here makes you strong and confident, your personality stands out, and it enables you to deal with any situation." BP has hired 40 technicians on to the programme, so far, and has sent the first group of technicians for an overseas training assignment at other BP locations in the US and the UK.

Invaluable information

Back in the desert, there are more immediate priorities with work going on by BP to decommission the extended well test (EWT) facility. This was designed to prove the deliverability of tight gas from the reservoirs within Block 61, as well as providing surface facility design data. Four production wells were tied back to a processing facility, which operated for more than two years. The project produced invaluable information that was a key factor in sanctioning the full-field development of Khazzan.

Paul Johnston, BP Oman onshore site manager for operations, says: "We shut down the last of our wells in January, and since then have been working to prepare for deconstruction activities. Our focus and priority will remain on process and personal safety throughout the decommissioning and deconstruction phases."

As one chapter of BP's history in Oman ends, the next brings immediate, new »



"BP has an excellent programme to develop our technical and leadership skills and to prepare us for greater responsibilities in the future. I see a bright future for BP in Oman, where competent Omani leaders will help guide the company to success."

Abbas Al Lawati

challenges, with an rapid ramp-up in the number of people onsite. One of the biggest tasks is to construct the camp facilities, including a new central accommodation complex that will house around 4,000 to 5,000 workers at the site.

At the peak of construction, there will be 8,000 to 10,000 people working within Block 6r. On any given day, there may be hundreds of vehicle movements and people working over a wide geographically-dispersed area of approximately 1,500 square kilometres (580 square miles). One of the biggest challenges is managing the safety of so many over a large geographic area.

For Julian O'Connell, vice president of projects for BP Oman, the importance of safety is paramount. "Everyone who comes into Block 6r will be given a common Block 6r induction. We'll make sure that the contractors and their control of



Signing ceremony: BP chief executive and Oman's minister of oil and gas, Dr Mohammed Al Rumhy sign the gas sales agreement and amended production sharing agreement in Muscat, 16 December 2013.

work processes are compliant with BP's procedures and are gap-assessed against the group designed practice for the control of work. The contractors will be managing their activities within their own control of work framework. We'll also have a team of BP health and safety experts to make sure that the contractors are adhering to their own safety working practices."

Geographically dispersed

Another challenge in delivering such a large, geographically-dispersed project in a remote desert location is worker welfare and 'life support'. Water, for example, is a basic need – not only to hydraulically fracture and stimulate 300 tight gas wells and for construction work, but also for people to drink. One of the initial project activities is to drill water wells into a brackish, salty aquifer within Block 6r and construct a temporary reverse osmosis plant to treat the water, along with a pipeline that will deliver the water to where it is needed. A large workforce in a hot environment will need a lot of water. People working for the project will also need decent accommodation and food, plus medical and recreation facilities. And,

"Nothing is impossible, you can do whatever you set your mind to."

Abeer El-Beloushi



every single vehicle movement in and out of the concession area will be controlled and tracked.

The Khazzan field development plan will involve drilling around 300 wells, mostly horizontal, using eight drilling rigs over 15 years. BP will aim to achieve production of around 1 billion cubic feet of gas per day.

“BP is applying innovative technology to unlock Khazzan’s potential,” explains new well delivery manager Steve Rainey. “We are drilling horizontal wells and using hydraulic fracturing technologies to stimulate production. The rocks we are drilling through are very hard, requiring focus on advanced hard rock drilling technologies. Through the application of advanced seismic imaging techniques, we hope to ensure that we drill our best wells first.”

Greater productivity

Although BP has overcome many of the challenges of unlocking this tight gas, there remain opportunities to better understand the subsurface and the drilling solutions required in the hydraulic fracturing process to optimise the Khazzan development. Paul Forman, vice president of wells for the Middle East region, says, “If we can drill

and stimulate these horizontal wells with the appropriate fracturing techniques, then we end up with greater well productivity and a better cost per barrel situation than we would with a vertical well.”

By the end of 2014, there will be five rigs operating within the block, with large-scale construction work starting up for the central processing facility (CPF), as well as the extensive work to build roads and well-pads, the central contractors’ accommodation, plus a camp for the wells contractors.

BP has taken time to plan rigorously. “What we’ve been doing for the past two to three years is preparing and framing the project for success,” says O’Connell. “That involves a lot of planning. Now, there’s a huge amount of activity to bring the contractors onboard, mobilise the rig and the rig crews and to make sure that they’re doing it all safely, helping them to understand our expectations in terms of how we operate safely and also guiding them in that process to do it effectively. We’re also working to mobilise the contractors and bring them onboard. The time this is taking, the rigour that’s gone into developing the best project for Oman – you can compare the process to preparing

for any race. You do a lot of training and preparation and now we’re out at the starting blocks, ready to move.”

Below the surface, the main technical challenges are well known. The common theme continuously discussed is the hard rock environment in Khazzan. Horizontal wells can yield significant value in terms of higher production rates, because they expose more of the reservoir to the well bore. However, fracturing and stimulating a horizontal well five kilometres (three miles) below the surface is no small task, but it is a challenge that BP’s technical teams are excited to work on.

That excitement is palpable at the KZN-14 well, being drilled by the Omani contractor Dalma, with the drill bit 4.5 kilometres (2.8 miles) down and into the horizontal section. The project is highly complex, but the use of bottom-hole instrumentation enables BP to ‘geo-steer’ the drill bit, to keep the well along the right path within the sandstone reservoir. This instrumentation allows BP to continuously collect new information about the target reservoir, and to monitor the location of the wellbore (the hole) itself using the angle from the vertical axis and compass points as coordinates.

Another important objective is to ensure that there are succession plans in place to develop, understand and promote talented Omani individuals into senior roles. Campbell says: “What makes me really excited about Khazzan is that it’s such a significant global project in BP and it’s also very important to Oman. This is about setting up a business that will last many decades and, hence, will benefit several generations of people in the Sultanate of Oman.”

There is much to look forward to with the Khazzan project for BP in Oman and for its growing local workforce. As the minister of oil and gas of the Sultanate of Oman, Dr Mohammed Al Rumhy, said in announcing the project: “As well as providing additional energy supply for Oman, the Khazzan project will generate wider direct benefit with the development of Omani employees and delivering in-country value through the development of the local supply chain.” The Khazzan project represents the first phase in the development of one of the Middle East region’s largest unconventional tight gas accumulations, which has the potential to be a major new source of gas supply for Oman over many decades. ■



In training: (left) Abeer El-Beloushi was the first woman to join the technicians’ development programme; (above) a member of the operations team at a compressor station.





SHIP SHAPE

Photographer Stuart Conway captured this shot at the Sembawang dry dock in Singapore. It shows a worker removing small barnacles from the underside of the hull of the *British Curlew*, which was in docks in February for its second special survey (its 10-year maintenance programme). In 2015, BP Shipping will celebrate its 100th anniversary. The British Tanker Company was first formed in 1915, with its first ship delivered a year later. It had an initial budget of \$144,000 to build seven steam-powered tankers. All would be prefixed British, a tradition that stands to this day. By 1924, the fleet numbered 60. At the end of 2013, BP's international fleet comprised 49 international vessels: 33 medium-size crude and product carriers, five very large crude carriers, eight liquefied natural gas (LNG) carriers and three liquefied petroleum gas (LPG) carriers. All these ships are double-hulled and of the eight LNG carriers, BP manages one on behalf of a joint venture in which it is a participant. ■



A bright future

BP's multi-billion-dollar investment at its Whiting refinery in the US firmly puts the plant at the heart of the company's fuels strategy for years to come. But, it's also had a major impact on the local economy and, as *BP Magazine* discovers, it couldn't have come at a better time.

REPORT > ERIC HANSON PHOTOGRAPHY > JOSHUA DRAKE

Light show: a night view of the new illuminated Foster Wheeler coker at BP's Whiting Refinery.

Whiting refinery in Northwest Indiana has always seemed to have been in the right place at the right time.

The BP plant was one part of the financial empire of oil tycoon John D Rockefeller, when it first began producing kerosene and other petroleum products in 1890. Situated on the southern shore of Lake Michigan, in the very heart of America's bustling industrial Midwest, the refinery prospered for decades, along with nearby Chicago and other cities of the region.

While, the past couple of decades have seen rough economic times in northern Indiana, as some of the steel mills and factories were shut down, BP's Whiting refinery continued making gasoline and other products.

And, today, the refinery is thriving, thanks to its location and a multi-billion-dollar investment that will make the plant the keystone of BP's US fuels strategy for years to come. The Whiting Refinery Modernisation Project (WRMP) saw the completion of commissioning of refinery units in December 2013, with all the major new units associated with the project successfully brought onstream.

The reconfigured refinery, located in the hub of a vast network of pipelines and railroads, can now process as much as 80% heavy crude oil from Canada, up from 20% in

the past, and this new capability is expected to deliver \$1 billion of operating cash flow per year, depending on market conditions.

"The Whiting Refinery Modernisation Project is a game changer for Whiting, essentially moving it to process mostly heavy-sour Canadian crude. And it's going to shift our competitive position dramatically," says Nick Spencer, vice president of refining.

The reconfigured refinery is a key part of BP's Northern Tier strategy, which also includes operating refineries in Toledo, Ohio and Cherry Point, Washington.

"The Whiting project is the foundation of our US fuels strategy," said Iain Conn, chief executive of BP's refining and marketing segment. "This refinery has unique flexibility in its ability to access and process crude, demonstrating our commitment to operate feedstock-advantaged Northern Tier US refineries that are tied to strong retail markets."

A PROJECT OF HISTORIC SIZE

The WRMP team carried out a complex project that was the largest private investment in the history of Indiana.

The team, which drew upon the experience of BP employees from all over the world, replaced old operating units with new ones that are safer, more efficient

and more capable. It also revamped many of the remaining operating units. This major construction programme was carried out while the refinery remained in operation, a feat that required extensive planning and meticulous execution.

"There are very few places in the world where a project of this scale has been done in an operating refinery," says Spencer.

The BP team had to work through a host of issues that ranged from mundane topics, such as finding parking spaces for thousands of contractors, to complicated construction challenges, such as lifting pieces of equipment weighing hundreds of tonnes over units that were still operating.

"We basically built a new refinery inside an operating one" says Reggie Waddell, operations superintendent.

THE NEW PROCESSING UNITS

One of the most important and complex tasks the team completed was the reconfiguration of the venerable 12 Pipestill, the refinery's main crude unit, which fractionates the crude oil into feed streams for further processing in downstream units.

And while 12 Pipestill was reconfigured, the team carried out work on three other major units.

A state-of-the-art petroleum coker was erected and the old one was decommissioned. »

Equipment inspection: A BP engineer performs a walkdown on the new condensate recovery system that was part of the refinery's modernisation programme at BP's Whiting Refinery.







Local impact: (opposite) more than 40 companies have invested in excess of \$350 million in northwest Indiana since the project began, including the Bulldog Brewery (main image), a microbrewery located in the historic part of Whiting. Other stores and restaurants (inset images) have also opened. Above, a Whiting refinery fire fighter during monthly training in the field. Below, BP construction managers inspect the inside of a furnace on the 12 Pipestill crude unit as part of the refinery's modernisation project.



WHITING STATS

610

kilometres of pipe were installed

50,000

tons of steel were used

1,200

pieces of major equipment were installed

600

shop-fabricated modules were used

Safety checks: Whiting workers discuss safety procedures before heavy lifting begins at the 12 Pipestill.



The new coker, the second-largest Foster Wheeler coker in the world, can process around 102,000 barrels per day. The unit converts residual oil into lighter naphtha, light and heavy gas oils for use in gasoline and diesel production, and petroleum coke, which can be used for power generation and other industrial applications.

The project also saw the building of a gasoil hydrotreater that reduces the sulphur, nitrogen, and aromatic hydrocarbons to acceptable levels to allow the subsequent processing of gas oil in Whiting's catalytic cracking units, where gasoline and diesel is produced.

And, the refinery is now equipped with additional sulphur recovery processing capacity that recovers the sulphur in the heavy sour crude.

The numbers surrounding the WRMP are impressive, says Spencer: at the peak of activity, there were more than 10,000 contractors working at the site. Meanwhile, 610 kilometres (380 miles) of pipeline have been installed, 50,000 tonnes of steel used, 1,200 pieces of major equipment installed, and 600 shop-fabricated modules used.

The gigantic project required extensive organisation and planning, as the refinery staff had to continue daily operations while construction and demolition was being done at the same time.

"It was very intricate. Credit should go to the teams that planned it and could put

a new line right next to an operating line and do it safely," says Ian Somerville, BP project manager, explaining that each day thousands of things had to be done right in order to correctly complete the project. "In live areas there was simply no margin for error," he says.

Jim Shoriak, WRMP project manager, says having a small army of extra workers on the site meant that in addition to finding extra parking space, the team had to provide food and other services.

Shoriak says the task was similar to staging a mid-sized sporting event every day of the year. "We got people in and got them out quicker than if they had gone to a football game. At a sporting event, you sit in traffic for two hours, we got everyone out in 15 to 20 minutes."

To help accomplish the daily movement, the BP team arranged for additional police officers to direct traffic on the streets and highways leading into the facility.

Shoriak says there was much more to the effort than just logistics and that it was important to instil a strong safety culture in the contractors. "The contractors told us we set a much higher standard than what they were used to working to. When you get a workforce that is not used to being in a refinery, that is when you have to make that extra effort."

Shoriak says the BP leaders told the contractors that it was very important

to speak up if they had a concern or saw something that needed attention. "It is all about safety. It is what you do when no one is around that really counts. Will you do the safe thing when no one is watching? Will you look for a hazard when nobody asked you to? That is the best kind of safety to have."

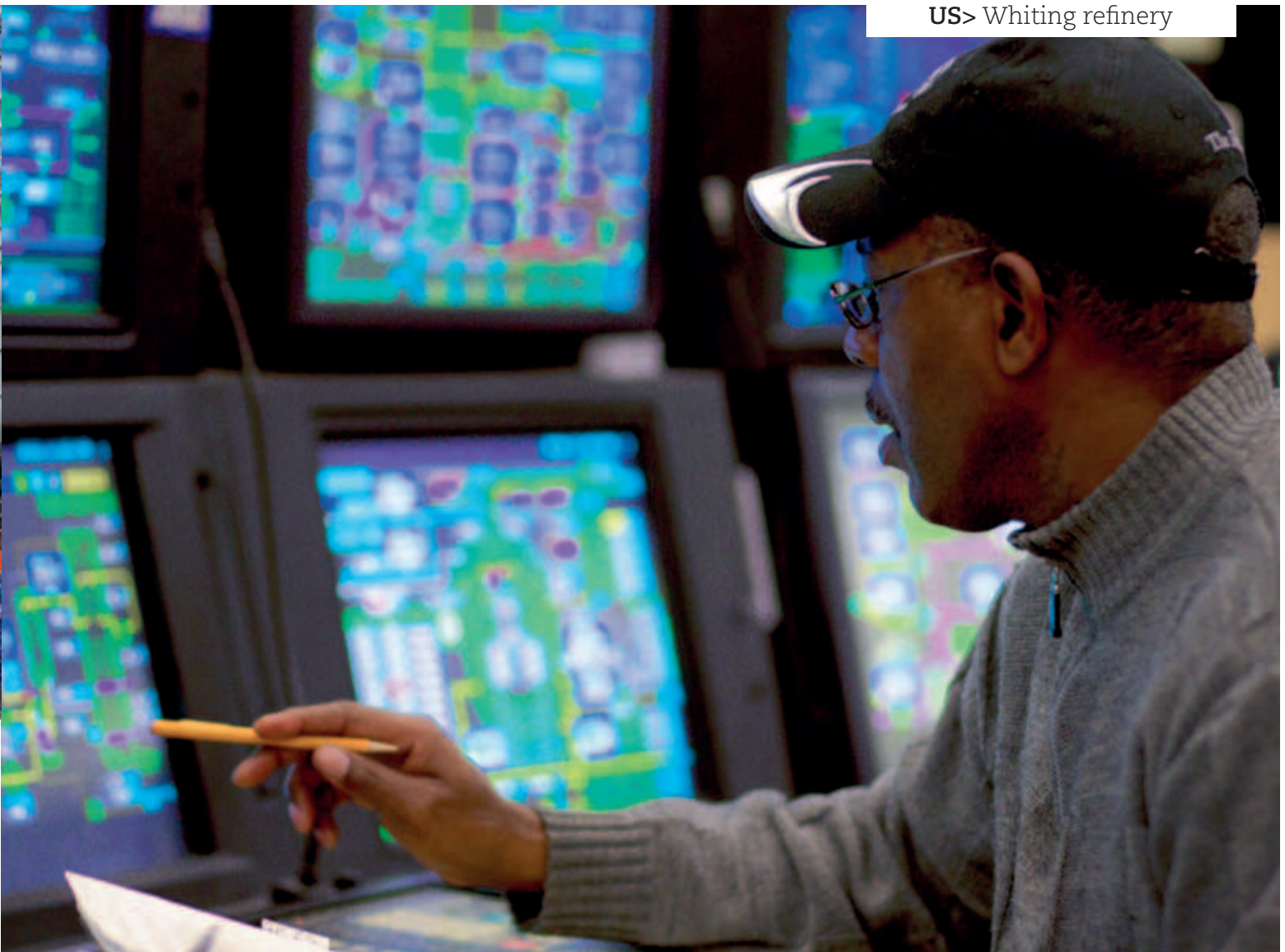
IMPACT ON THE LOCAL ECONOMY

The WRMP provided a gigantic boost to the economy of the region, says Don Koliboski, economic development director for the Northwest Indiana Forum, a group focused on the economic development of the seven-county region around Whiting.

"The national economy took a dip in 2008. That is when the modernisation began, so from an economic standpoint, it saved Northwest Indiana from major distress," he says.

Koliboski says BP's huge investment in the area encouraged other companies to embark on big capital projects. "There was a ripple effect with other major industries that could use the labour force that was mobilised by the [Whiting] modernisation."

Karen Lauerman, director of marketing and communications for the forum, grew up in the shadow of the refinery, where her great grandfather, grandfather and uncles worked. She says the modernisation served as a catalyst for other businesses, because the BP investment in the refinery



demonstrates a commitment to the plant for many years to come.

She says more than 40 companies have invested in excess of \$350 million in Northwest Indiana since the project began.

“They see this as an opportunity to serve the people who work at BP; restaurants have opened, a microbrewery opened. And, we have had growth in manufacturing. They know that BP is here to stay,” Lauerman says.

Whiting’s mayor, Joseph M Stahura, says the refinery has always played a large role in the town’s life and continues to do so.

“The refinery is our largest taxpayer, our largest land owner, the largest water consumer. It is a huge part of our community in every aspect,” says Stahura who worked at the refinery for 22 years, when it was owned by Amoco. They have been great corporate partners with us over the many years. When people think of Whiting, the first thing they think is the refinery.” ■

Daily life: (above) an operator works at computer screens in Whiting’s central control complex. Right, a contractor completes welds in front of the 12 Pipestill towers.

DID YOU KNOW?

On an average day, the refinery makes enough products to fuel 430,000 cars, 10,000 tractors, 22,000 commercial trucks, and 2,000 commercial jet liners.

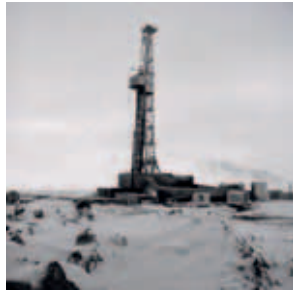




Northern highlights

It's 45 years since BP first struck oil in the giant Prudhoe Bay field in Alaska. A lot has changed since then, but as *BP Magazine* discovers, the region has remained one of the company's leading resource basins, providing crucial energy supplies to the US market.





In 1969, BP made what would become one of the company's most significant discoveries: oil under Alaska's North Slope. The BP confirmation well came a year after its rival – and now heritage company – ARCO, along with its partner, Exxon, announced that they had discovered what turned out to be another part of the largest oilfield ever found on US soil. It could have been a very different story, though – the first 11 North Slope wells were costly failures and it appeared that the whole region would be written off. But BP's discovery just a few kilometres away from the ARCO discovery confirmed that the Prudhoe Bay field was a giant of Middle Eastern proportions.

BP first opened an office in downtown Anchorage in 1959 – the same year that Alaska was officially made a US state, but the territory's potential was first mentioned within BP in its 1952 world survey of oil prospects, compiled by the company's exploration department in London – what is now the annual *BP Statistical Review of World Energy*.

Less than a decade after the discovery, first oil flowed through the newly-constructed Trans-Alaska Pipeline System. Forty-five years later, Alaska remains one of BP's leading resource basins and has repeatedly been a testbed for some of the company's latest production technology. Over the next pages, *BP Magazine* looks at some of the company's Alaskan highlights.



BP is one of the biggest oil producers in the state, operating 13 oilfields on the North Slope (including Prudhoe Bay, Endicott, Northstar and Milne Point). This accounts for around two thirds of total Alaska oil production, or approximately 400,000 barrels a day – enough energy to meet the needs of 4.4 million homes, or every household in Alaska, Washington and Oregon. Prudhoe Bay still ranks among the 20 largest fields ever discovered.

“If we can live and work here, in these conditions, we can go to Mars.”

Apollo 17 astronaut and New Mexico senator Harrison Schmitt, during a visit to Prudhoe Bay in the 1970s



1959

Alaska becomes a US state. BP opens an office in Anchorage

1968

ARCO and its partner, Exxon, confirm the discovery of the largest oilfield ever found on US soil, in northern Alaska, prompting rival BP to get back to its own search nearby

1969

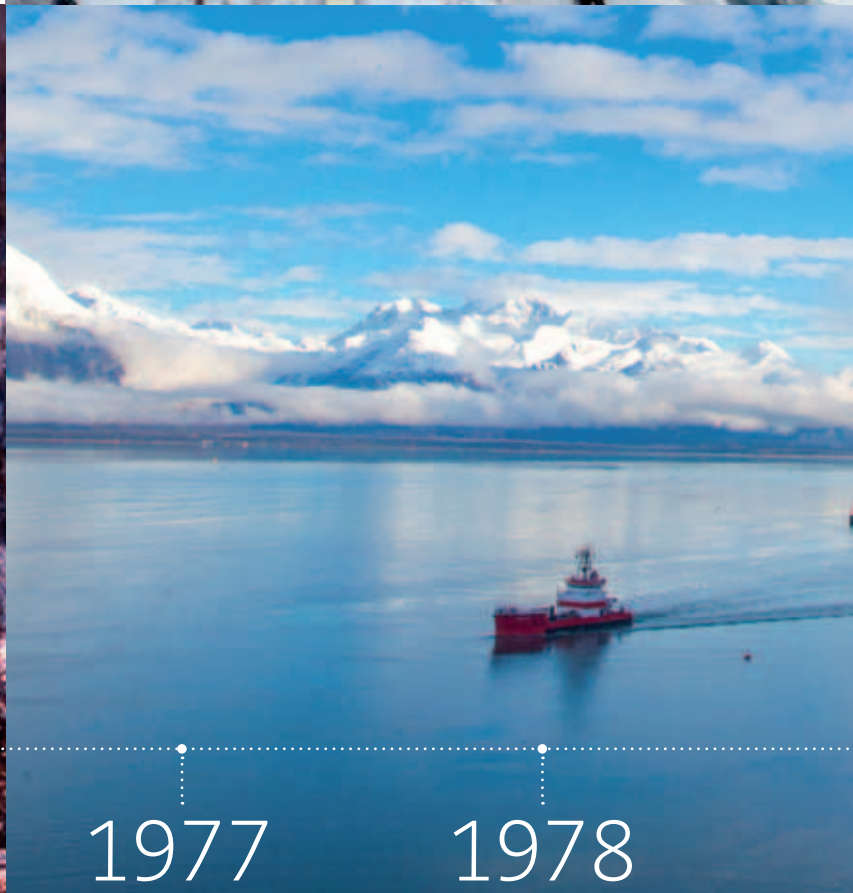
On 13 March, BP announces its own discovery under Alaska’s North Slope. It is made after the daunting task of drilling oil wells in sub-zero conditions through 600 metres (2,000 feet) of permafrost, before another 1,900 metres (6,000 feet) of porous sandstone, to reach Prudhoe’s rich oil reservoir. The company has no infrastructure in the US, so one year later, takes a 25% stake in Sohio in order to refine and market its Alaskan crude

1971

BP becomes Sohio’s majority shareholder

BP holds the greatest ownership share in the 1,287-kilometre (800-mile) Trans-Alaska Pipeline System (TAPS). The pipeline crosses three mountain ranges and 800 rivers and streams, transporting crude oil from Prudhoe Bay to the ice-free port of Valdez on Prince William Sound. Since production began in 1977, more than 16 billion barrels of oil have travelled through TAPS.

By early 1978, BP and ARCO achieved a Prudhoe Bay field daily production rate of slightly more than 1 million barrels. The 2 million barrel-per-day plateau rate was achieved in 1981, and was sustained until 1989, when the field began its natural decline.



1974

1976

1977

1978

Construction of the Trans-Alaska Pipeline System (TAPS) begins

Alaska Permanent Fund is created

At 10.26am on 20 June, TAPS receives first oil from Prudhoe Bay. The oil arrives in Valdez on 28 July and is loaded onto a tanker destined for the US West Coast on 1 August

The first offshore US Arctic oilfield – Endicott – is discovered



Using enhanced oil recovery technologies, the BP-operated Prudhoe Bay field will be in production twice as long as first predicted. Meanwhile, directional drilling allows many more wells to be drilled from a surface location, with wells that were once spaced more than 36 metres (120 feet) apart at the surface, now as close as three metres (10 feet). Advanced drilling techniques also mean that the surface footprint at the Endicott field is 70% smaller than the traditional North Slope 'development pad'.

BP is one of Alaska's largest private sector investors, taxpayers and employers, and in 2012, paid more than \$2.8 billion in taxes, royalties and other government payments to the State of Alaska. It is one of the top-10 employers in Alaska, with more than 2,300 employees and 6,000 contractors.



1981

Kuparuk oilfield begins production

1984

Seawater Treatment Plant is installed. A major waterflood project begins to boost Prudhoe Bay production

1986

The Prudhoe Bay Central Gas Facility starts up. It is the largest facility of its kind in world

1987

BP acquires the remaining share of Sohio for \$7.7 billion

BP conducts a variety of studies on the North Slope to better understand its impact on the fragile environment. Environmental studies, including air and water quality sampling, and land and marine mammal and bird surveys, help assist project engineers with the routing and placement of gravel roads and pads to minimise environmental impacts. The company also conducts studies to support permits, including water source sampling for ice road construction and cultural resource clearance to ensure that activities avoid known cultural or historic sites. Extensive research has shown that North Slope development has had minimal impact on fish and wildlife populations. For example, the number of Central Arctic Herd caribou moving through the Prudhoe, Kuparuk and Alpine oilfields has increased from 3,000 in 1972, when development began, to about 70,000 today. More than 200 species of waterfowl and shorebirds migrate to the North Slope each spring. These include Canada geese, snow geese, tundra swans, white-fronted geese, loons and waterfowl, such as long-tailed ducks, pintails, scaup and four species of eider ducks. Barren-ground grizzly bears, Arctic foxes, wolves, Arctic hares, musk oxen, ground squirrels, lemmings and other wildlife roam the North Slope as they did prior to development. Fish, such as Arctic char, whitefish and grayling, spawn in the upper reaches of rivers such as the Sagavanirktok, Kuparuk, Canning and Colville.



Since production began, around 16 billion barrels of oil have been sent to the US market, accounting for an average 10% of the nation's production.

IN NUMBERS

\$28 million

Amount BP has invested in the past 10 years to support the development of Alaskan education and workforce programmes

1,000

Number of Alaska Native students involved with the Alaska Native Science and Engineering Program (ANSEP), which BP helped to initiate

\$5 million

Amount BP contributed in 2012 to support non-profit and educational organisations in Alaska

6.3 billion

BP's net production (barrels of oil) from Alaska's North Slope since 1977 – enough energy to fuel and power the entire space programme since NASA was founded in 1958

700

Number of Alaska high school graduates who have received scholarships from BP worth \$3 million since 1985

+56,000

Number of jobs in Alaska, excluding construction of TAPS, created by the oil industry

1989

The Alaska Permanent Fund reaches \$10 billion

1994

BP acquires the Milne Point field. Point McIntyre and Niakuk fields begin production

2000

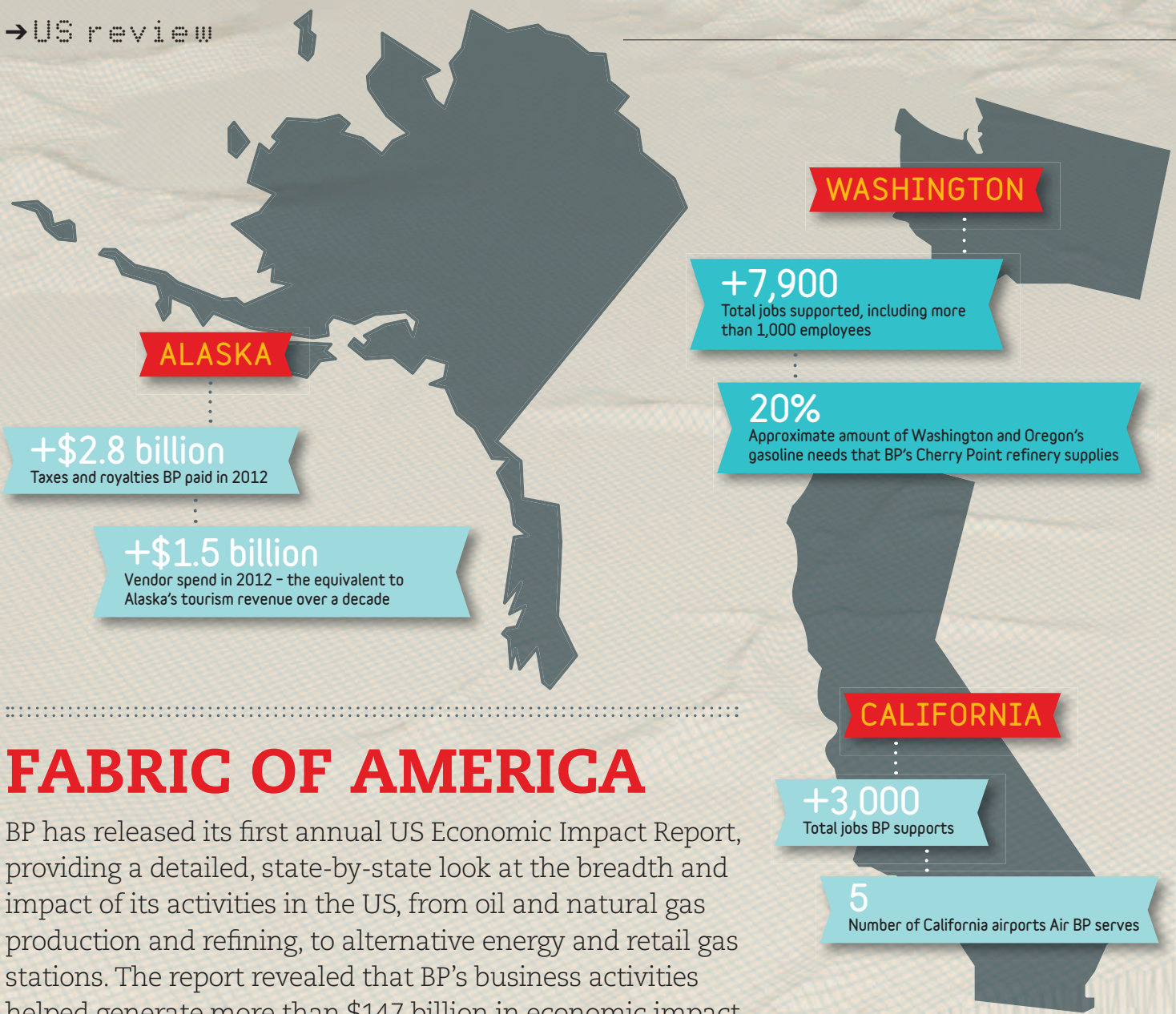
BP acquires ARCO

2001

Northstar field begins production

2014

The Alaska Permanent Fund reaches \$50 billion



FABRIC OF AMERICA

BP has released its first annual US Economic Impact Report, providing a detailed, state-by-state look at the breadth and impact of its activities in the US, from oil and natural gas production and refining, to alternative energy and retail gas stations. The report revealed that BP's business activities helped generate more than \$147 billion in economic impact in 2012 and support more than 260,000 jobs. The statistics highlighted on the next few pages represent the 20 states in which BP's presence is strongest and are just a few of the total that are featured in the full report.

BP IN THE US

#1

Energy investor over the past five years

+260,000

Total jobs supported by BP in the US, including employees

+\$25 BILLION

Total vendor spend in 2012. More than 15,000 vendors received BP funds

\$100 MILLION

Annual amount BP spends on academic research, educational initiatives and recruitment activities at more than 50 US universities

+\$191.2 million

Total royalties, property, production and other related taxes paid

2,000

Approximate number of wells BP operates in the Wamsutter field. It also holds an interest in 352,000 leased acres

WYOMING

550 million

BP's approximate amount of gas production (in cubic feet per day gross) from the San Juan basin

+165,000

Number of US homes that can be powered by the energy produced from BP's jointly-owned Cedar Creek I and II wind farms

COLORADO

+\$74.5 million

Total royalties, property, production and other related taxes paid

+1,290

Number of natural gas wells that BP's North America Gas business has in the Arkoma and Woodford basins

NEW MEXICO

+2,100

Number of producing wells that BP operates. It also has an interest in more than 4,800 wells operated by other companies

\$5 million

Amount BP donated in 2012 to San Juan College's School of Energy to build a new educational training facility to grow industry workforce training. Through its ongoing support, BP has helped train almost 2,500 workers

TEXAS

+\$10.5 billion

Vendor spend - equal to the amount spent on transportation infrastructure in Texas by local, state and federal governments annually

+\$161.7 million

Total royalties, property, production and other related taxes paid

LOUISIANA

12,000

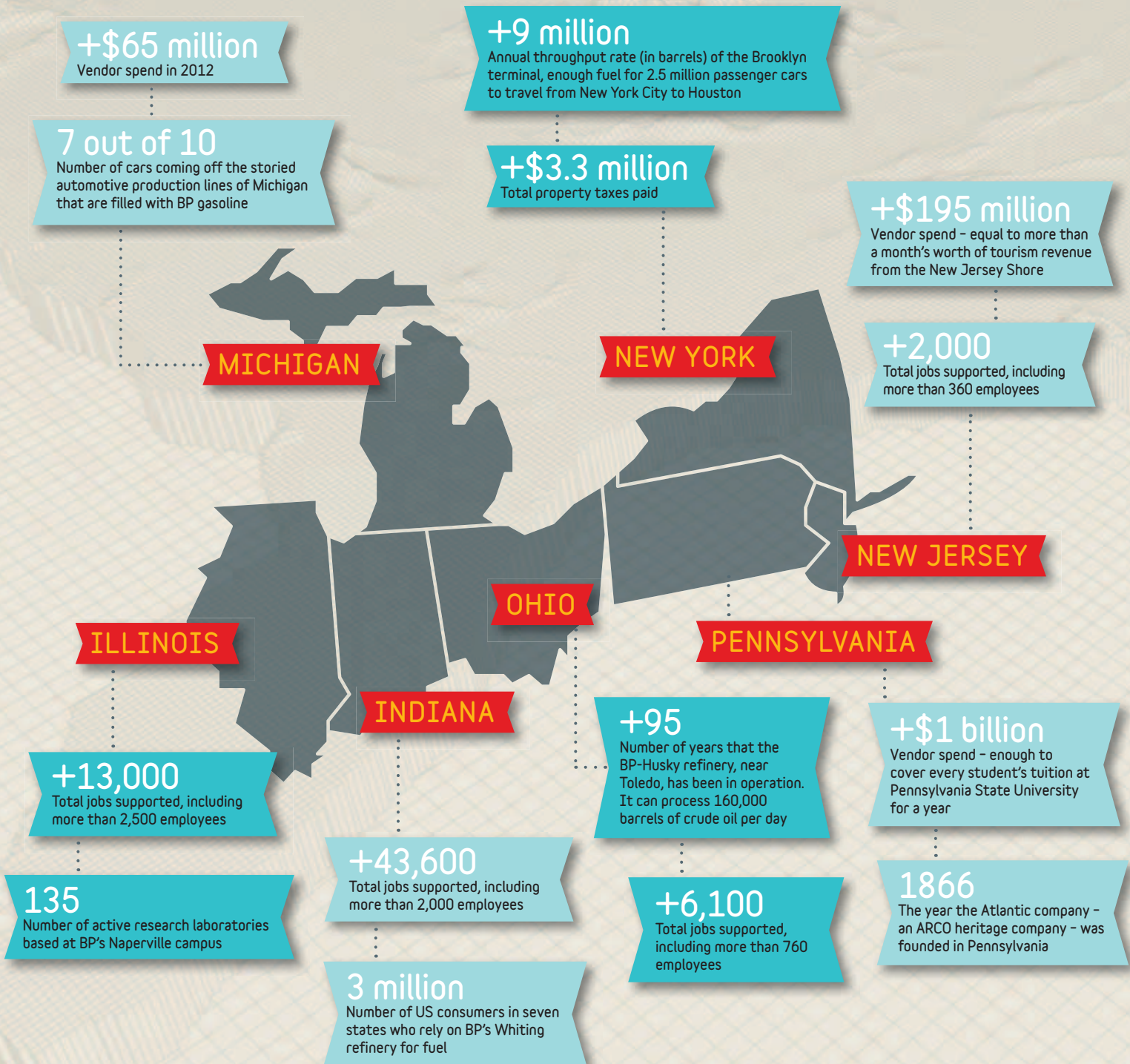
Number of people each month prepared and transported to offshore facilities from BP's deepwater GoM staging area in Houma

1.4 million

Number of gallons of cellulosic biofuel produced every year at BP's demonstration facility in Jennings

“Year after year, state by state, supplier by supplier, employee by employee, gas station by gas station, we are part of the fabric of America and that is how we want to remain. We are America’s top energy investor for a reason. We admire the calibre of the American workforce, the quality of America’s natural resources, and the dynamic future ahead of it. Our company strategy is built on a strong US business. We believe the prosperity of the US and BP are inextricably linked.”

Bob Dudley, BP’s chief executive, speaking at the Report’s launch



900,000

Approximate amount of PTA (in metric tons) produced at BP's Decatur petrochemicals plant every year

+\$100 million

Annual amount that BP's award-winning Cooper River petrochemicals plant pumps into the economy through payroll and third-party expenditure

+\$105 million

Vendor spend in 2012 - enough to rebuild the original University of Alabama football stadium 40 times over

1.27 million

Combined amount of PTA (in metric tons) that Cooper River's two major units can produce every year, making it the largest plant of its kind in the US

SOUTH CAROLINA

ALABAMA

MISSISSIPPI

+\$320 million

Vendor spend in 2012 - three times the cost of Florida's Seven Mile Bridge, one of the longest bridges in America (in today's dollars, based on cost when first built)

+50%

Amount of BP's deepwater Gulf of Mexico gas that the company's Pascagoula gas plant processes

+300

Number of retail stations

+1,500

Total jobs supported, including more than 55 employees

FLORIDA

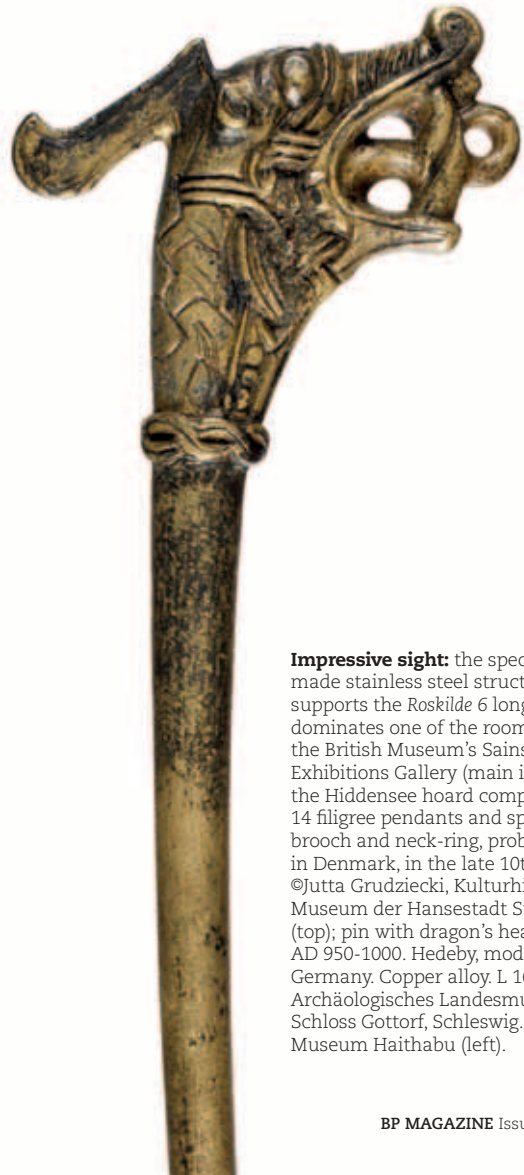
TOP FIVE STATES FOR BP TOTAL JOBS SUPPORTED (INCLUDES EMPLOYEES)

| Texas | Indiana | Alaska | Illinois | Washington |
|---------|---------|---------|----------|------------|
| +47,600 | +43,600 | +22,500 | +13,000 | +7,900 |

THE VIKINGS HAVE LANDED

More than 30 years since its last Viking exhibition, the British Museum is hoping to inspire a new generation of visitors, not least with a 37-metre longboat that was found, by chance, under a car park.





Impressive sight: the specially-made stainless steel structure that supports the Roskilde 6 longboat dominates one of the rooms in the British Museum's Sainsbury Exhibitions Gallery (main image); the Hiddensee hoard comprising 14 filigree pendants and spacers, a brooch and neck-ring, probably made in Denmark, in the late 10th century. ©Jutta Grudziecki, Kulturhistorisches Museum der Hansestadt Stralsund (top); pin with dragon's head, AD 950-1000. Hedeby, modern Germany. Copper alloy. L 16.2 cm. Archäologisches Landesmuseum, Schloss Gottorf, Schleswig. ©Wiking Museum Haithabu (left).



It seems all the best archaeological discoveries these days are made in car parks. Early in 2013, the British press buzzed with the confirmation that the battle-scarred remains of King Richard III had been found below what is now Leicester City Council's car park. Imagine then, the surprise the staff at Denmark's Roskilde Viking Ship Museum must have felt in 1997, when not one but nine ancient Viking longboats were unearthed during excavation work that was due to turn their car park into a brand new workshop space for their replica ships.

Now, one of those longboats is on show at the British Museum in the BP exhibition *Vikings: life and legend*. The exhibition is a collaborative effort between the British Museum, the National Museum of Denmark, and the Museum für Vor- und Frühgeschichte, Staatliche Museen zu Berlin. It's the first exhibition to open in the British Museum's Sainsbury Exhibitions Gallery, part of its newly-created World Conservation and Exhibitions Centre.

Dispelling myths

More significantly, it's the first Viking exhibition of its kind at the British Museum in more than 30 years and the museum hopes it will bring this spectacular age to life for a brand new generation, while laying to rest one or two myths about this fearsome race: starting with the fact that the Vikings weren't, strictly speaking, a race at all.

"The word Viking means raider or pirate," says Gareth Williams, lead curator and the museum's permanent curator for Early Medieval coinage. "It has become a very necessary blanket term for late-Iron Age Scandinavia." It certainly doesn't trip off the tongue in quite the same way.

Williams's involvement in the exhibition is serendipitous. As a child, he borrowed a book on Vikings from the local library so many times that eventually his parents simply bought him his own copy. He could frequently be found sporting his cardboard horned helmet and shield, made for him by his grandmother, and on his 11th birthday, he was taken to that original British Museum exhibition as a treat. It would cement what was to become a life-long passion, albeit one that he says perhaps occurred for "the wrong reasons".

Simply because our knowledge



Treasure trove: (top) Hunterston Brooch, c. 700, Hunterston, Ayrshire, Scotland. Gold, silver, amber. ©National Museums Scotland; (above) part of the Vale of York hoard; (left) the Roskilde 6 structure was designed to be portable, which means the structure must be rebuilt at each new location; (opposite) project curator Tom Williams discusses the new exhibition on camera.



of this period of history has developed and changed dramatically in the past 30 years. Any basic Google search on the word Viking brings up a raft of cartoons depicting slightly portly, bearded men with the standard issue horned helmet. The cartoon strip *Hägar the Horrible*, first seen in 1973 and still going strong, has a lot to answer for.

However, the rise in amateur metal detecting has brought a sharp increase in discoveries that provide a much fuller and more complex picture. For example, one aspect of Viking culture that has become increasingly evident – and is on display at the exhibition – is a deep love of what can only be described as ‘bling’ and the sheer level of craftsmanship that went in to producing it.

Fine metalwork

The Hiddensee hoard, for example, found off the Baltic coast of Germany, is rich with gold filigree and includes a series of gold pendants that, together, weigh around 650 grams. It’s heavy and completely impractical. It’s also stunning. “If anyone thinks the Vikings were just a bunch of barbarians,” says Williams, “who could only cause damage, well, try making something like that yourself.”

In northern England, the number of finds since Williams began working at the British Museum in 1996, compared with all the hoards ever recorded in history, has roughly doubled – providing more evidence of the Vikings’ travels and experiences.

Discoveries such as the Vale of York hoard. Found in 2007 by metal detectorists near Harrogate, the hoard is the largest and most important discovery of coins, jewellery, bullion, and hack-silver in more

than 150 years. Packed in a Frankish silver cup, it includes 617 coins of Frankish, Viking, Anglo-Saxon, Afghan and Uzbek origin, along with pieces of Russian and Irish jewellery. Thor’s hammer features on the Viking coins, but the cup itself is a Christian vessel, likely plundered from a church.

“Discoveries in places such as York and Dublin have revolutionised our understanding,” says Williams. “For instance, there’s a new Viking coin type in the Vale of York hoard, which helps us rewrite the political landscape of England a little.”

Coins are invaluable for piecing together historical evidence, since they offer physical proof of trade and movement. “The single most common coin inscription that we have from Viking Scandinavia is ‘There is no God but Allah, he has no partner’, simply because of the vast quantities of coins from the Islamic world that ended up in Scandinavia,” says Williams. These coins, coupled with a significant amount of Arab writings that mention the Vikings, offer hard evidence of the distances travelled.

Indeed, the scale of Viking movement is remarkable. Evidence shows that they travelled as far west as what is now North America, as far south as Morocco, and as far east as south Malaysia. There was plenty of marauding going on, but there was also, says Williams, “a huge cultural exchange.” The Hiddensee hoard, for instance, offers evidence of intermarriage between Vikings and Slavs and might have been a diplomatic gift.

Even the weapons are beautiful. “They obviously had a fairly bloody function,” says Williams, “but that didn’t mean they couldn’t look beautiful and stylish at the same time.”

There is no getting away from the violent nature of the Vikings and the sight of a 37-metre warship heading for your shores must have been terrifying. But, this was a violent age of history generally and the purpose of the exhibition is to show a more rounded perspective, one that acknowledges the grey areas and openly discusses the problematic question of whether the Vikings were raiders or traders. Mind you, even that is fraught with complexity. “We have a slave collar in the exhibition,” says Williams, “which is a reminder that trading itself was not purely a peaceful activity. You cannot always simply divide between the two. I hope that is one of the things that will strike visitors.”

The exhibition also delves into the rituals and beliefs that Vikings held, and two displays are dedicated to the sorceresses of the Viking Age – women who later on would have been condemned as witches. Williams says: “These women are part-witch, part-sorceress, part-priestess, part-shaman, and a number of graves have now been identified as belonging to specific individuals. Historically, there has been a tendency to assume Vikings followed a fairly Germanic belief system, but more recent thinking and discoveries suggest a more diverse approach and one more akin to sub-Arctic shamanism, particularly from the Baltic region.” Neil Price, professor of archaeology at the University of Aberdeen, is an expert in this field and has provided the museum with a lot of support for this section of the exhibition.

As well as two iron staffs – effectively magic wands – visitors can see a vessel found in a grave that analysis has shown to contain traces of hebane – a hallucinogenic »

On display: the exhibition is the first to open in the British Museum's Sainsbury Exhibitions Gallery, which is part of its newly-created World Conservation and Exhibitions Centre.



ROSKILDE 6 IN NUMBERS

32 metres

Length of the keel

37.4 metres

Full length of the ship, including stem and stern

80 centimetres

The distance between the metal ribs

39

Approximate number of pairs of oars

78

Approximate number of oarsmen



THE BP CONNECTION

BP is a major supporter of UK arts, with a programme that spans more than 35 years. In that time, more than 50 million people have engaged and connected with cultural experiences supported by the company. BP has supported the British Museum since 1996. In 2011, BP announced it was to invest almost £10 million in extending its long-term partnerships with the British Museum, the National Portrait Gallery, Tate and the Royal Opera House until 2017. It represents one of the most significant long-term corporate investments in UK arts and culture.

“BP’s support for arts and culture is part of the company’s wider contribution to society, connecting people with cultural experiences,” says Des Violaris, the company’s UK arts and culture director. “The BP exhibition *Vikings: life and legend*, is the first in this new five-year deal and aims to remind visitors of the scale of Viking exploration.”

Without corporate support, an exhibition like this would simply not be possible, says Gareth Williams, the exhibition’s lead curator. “In the current environment, as part of wider public service cuts, we are taking an overall cut of 15%. But even without that, a topic as vast as the Vikings would not be possible without external sponsorship. We simply cannot do it from our collections alone.”

In addition to *Vikings: life and legend*, BP’s 2014 programme includes the annual BP Big Screens – live relays of performances at the Royal Opera House onto giant screens across the UK – the annual BP Portrait Award, which will be on display in both London and Edinburgh and, later in the year, the BP exhibition, *Ming: 50 years that changed China*, at the British Museum, highlighting a golden age in Chinese history.

drug. “It ties in with the shamanism and female sorcery,” says Williams.

The heart of this exhibition, though, lies in the longboat known as *Roskilde 6*. At 37 metres, it is the longest ever found and a full four metres longer than Henry VIII’s flagship *Mary Rose*, built some 500 years later. Its timbers represent around 25% of the original ship and are supported by a custom-made stainless steel structure that dominates the exhibition room.

According to Williams, the ship was always at the centre of their plans. “When the idea of a collaborative exhibition first came up about six years ago, one of the things we said straight away was, let’s look at conserving the timbers so that they can become a touring exhibit.”

Conserving wood is a slow, painstaking process. Waterlogged wood looks perfect when revealed. However, over time, the cellulose and hemicellulose components inside the wood cells have degraded and the structure becomes filled by the water. It swells the wood, giving the impression of

a smooth surface. But if left to dry without treatment, the wood will eventually crack and deteriorate. “Once that happens,” says Kristiane Straetkvern, conservator at the National Museum of Denmark, “the process cannot be reversed.”

Slow process

So, conservators use a product called polyethylene glycol (PEG), a kind of water-soluble wax. The PEG molecules can diffuse into the wood, so that when wooden objects are immersed in a PEG/water solution, the water is slowly replaced with the chemical. It can take up to 10 years to impregnate large pieces of wood.

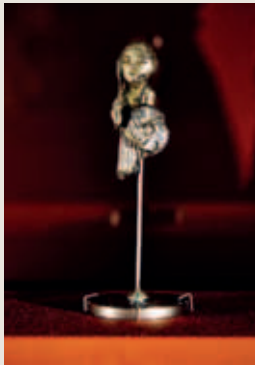
Once complete, each *Roskilde 6* timber was freeze-dried, a process that takes another five months per piece. Interestingly, the *Mary Rose* also used a type of BP-produced PEG, but instead of the freeze-drying, the ship’s size meant that it had to be air dried, an even slower process.

“When we conserved the timbers, we had to be sure we could put them back

together afterwards, like a jigsaw,” says Straetkvern. “Many of the planks had curves, particularly the keel, so it meant we could not dry them completely flat. Those curvatures had to be reconstructed before the drying process began.”

To do that, a ship reconstruction specialist drew up detailed documentation before the conservation process even began. From there, a 1:10 scale cardboard model of the ship was created and transferred to drawings, which allowed conservators to adjust each plank to the precise position before re-drying. This is not a job for someone lacking in patience.

The specially-designed stainless steel structure that supports the timbers is a sight to behold in its own right. Not least because the whole thing is portable. Ordinarily, a longboat of this sort would be displayed in a permanent exhibition but, like the men who navigated the seas in it, this one was meant to travel, heading to Berlin once the British Museum exhibition closes. “No one has really done that before,” says Straetkvern.



CURATOR’S CHOICE

Found in Denmark in 2012, and the most recent discovery to feature in *Vikings: life and legend*, this tiny figure (above) holds a sword and shield and, says Gareth Williams, “may be interpreted as a Valkyrie [a female figure in Norse mythology who decides which soldiers die in battle and which live]. There have been other figures found, but they were all effectively two dimensional. This one is a little more three dimensional.”



Check mate: (above) the Lewis Chessmen, made of walrus ivory and whales’ teeth, were found under mysterious circumstances on the Isle of Lewis, sometime before 11 April 1831. No one is sure who they belonged to or why they were hidden. They form the largest single surviving group of objects from the 11th century that were made purely for recreational purposes; (top right) penny of Anlaf Guthfrithsson of Northumbria (939–41). England. Silver. ©The Trustees of the British Museum; (far right) a neck ring.



“Discoveries in places such as York and Dublin have revolutionised our understanding. For instance, there’s a new Viking coin type in the Vale of York hoard, which helps us rewrite the political landscape of England a little.”

Gareth Williams, lead curator

In addition to giving structure to the whole ship, the metal supports have been laser cut to mirror the contours of the specific planks and provide them with exact individual support; each plank has its own specially built cardboard box; and the metal framework breaks up to fit on trollies, with which the entire steel frame can be moved around. It might just be the world’s largest three-dimensional jigsaw puzzle.

But the ship’s length and portability aren’t the only impressive things about it. During the documentation process, the timbers were also dated by dendrochronologists. These scientists count the rings of a tree to establish an accurate age, while the patterns of the annual growth rings also reveal details about the climate and the location in which the tree grew.

Although the exact date is not yet known, the results from the dendrochronological studies show that *Roskilde 6* was built in approximately AD1025. It’s also known that the timber

was grown in the royal forests of Lutvann, Norway – its profile matches that of the *Gokstad* Viking ship that can be seen in the Viking Museum in Norway – and that, at some point, some repairs were made using wood from the Baltic area. The ship’s size and the amount of resources needed to build it – it’s estimated that it would have taken up to 30,000 hours of skilled work – suggest this was almost certainly a royal warship.

The date is crucial. This was the height of the Viking Age, when what is now England, Denmark, Norway and possibly parts of Sweden were united under the rule of Cnut (also written Canute) the Great. Not without

a few fights, of course, and it is possible that *Roskilde 6* was connected with the wars Cnut fought to assert his authority over this short-lived North Sea empire.

“This boat could well be something built by King Olaf Haraldsson in an attempt to defend Norway against Cnut,” says Tom Williams, project curator working with Gareth Williams on the exhibition. “Equally, it could be something built by Cnut, having defeated Haraldsson, in a very dramatic statement to use royal timber to build his flagship. It says ‘I’ve arrived. I’m the top dog in town.’”

Maritime culture

Either way, this ship, and the Vikings’ maritime credentials, bind every aspect of this exhibition. A preserved section of boat burial – the metaphorical transport to the afterlife – found a couple of years ago in western Scotland, is on display, alongside memorial stones that depict ships, a brooch in the shape of a ship, and even model toy ships. As visitors arrive at the exhibition, they hear Old Norse being spoken and at the end a voice in the Shetland dialect, both are talking about boats. Indeed, a lot of boat terminology in Shetland dialect is derived directly from Old Norse.

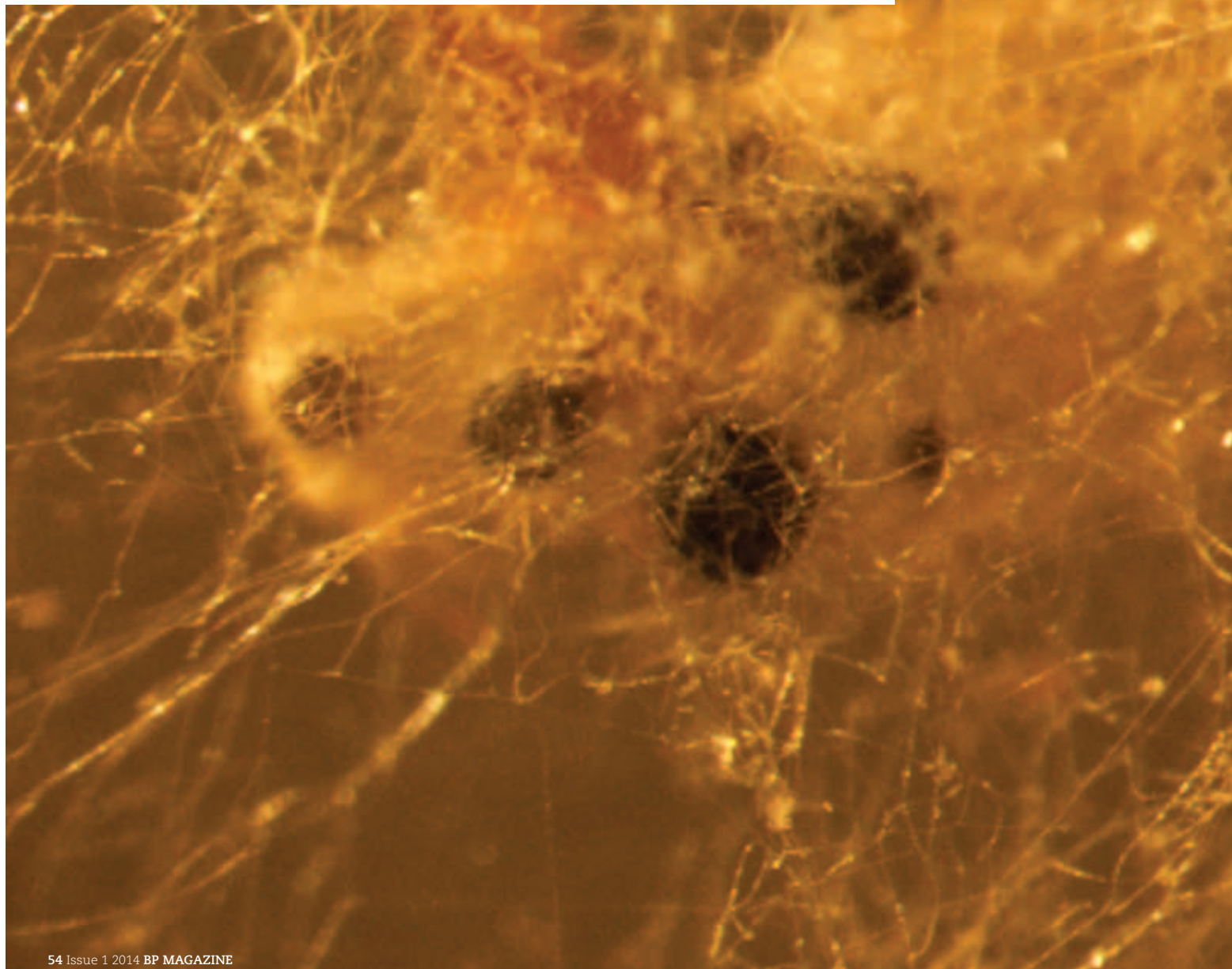
“The whole spectrum of life is seen through this maritime culture,” says Gareth Williams. “Their children played with ships and it was ships that enabled this huge cultural exchange with the rest of the world. Ships communicate power and authority and they transport you to the afterlife.”

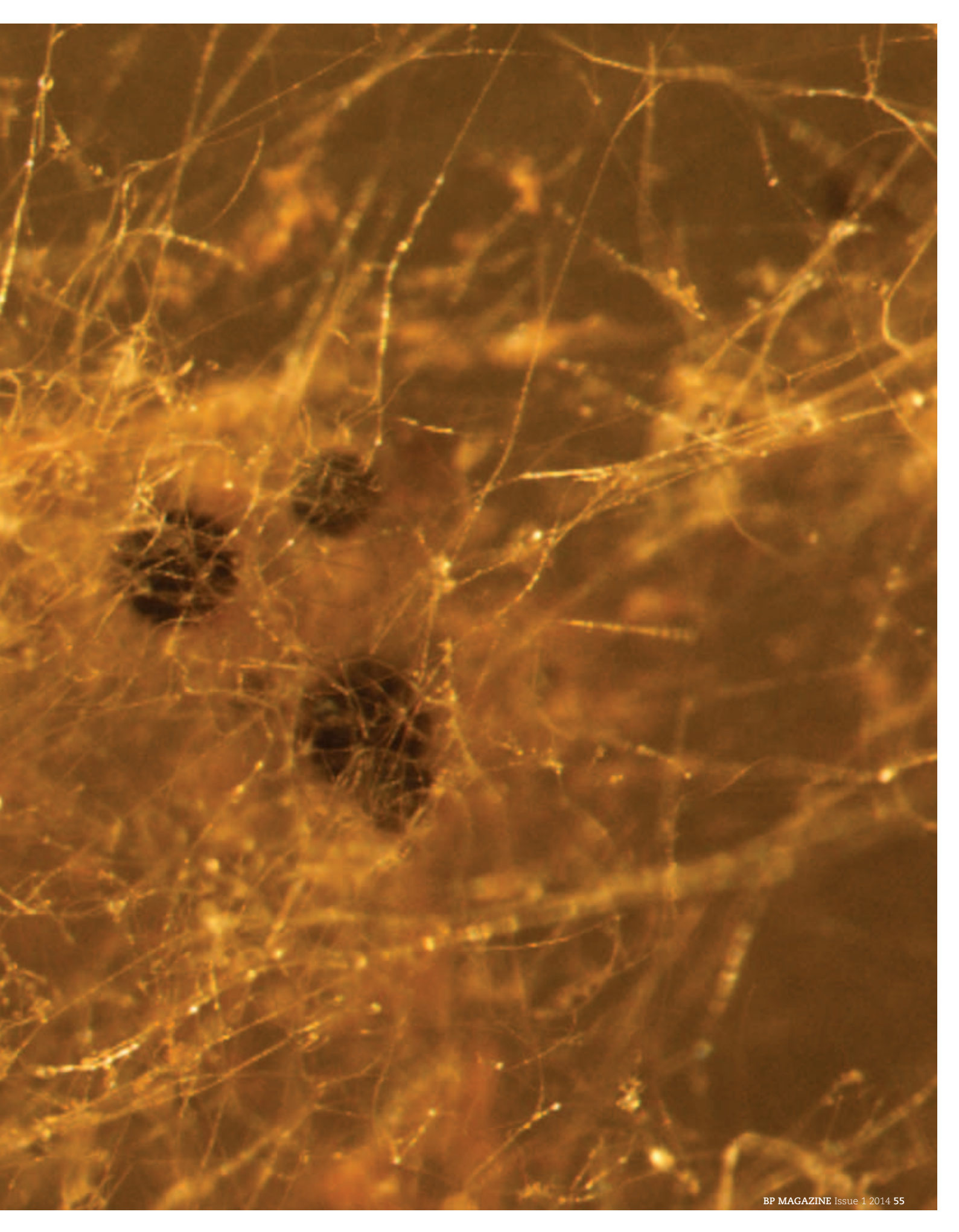
There’s no way one exhibition can do full justice to the breadth and depth of this fascinating period of history, not least because new discoveries are still being made. But, what it can do is inspire and delight another generation with new research and new discoveries in unlikely places. In the end, it reveals that the Viking Age was a beautiful, if bloody, one, that was even more connected than we first imagined. ■



Creative science

It looks like an abstract piece of art, but in fact this image is a piece of scientific work and is one of many to feature in the third annual *Art in Science* exhibition. For two evenings in February, the Energy Biosciences building in Berkeley – home of the BP-funded Energy Biosciences Institute public-private research partnership – was transformed into a fancy art gallery, where more than 500 curious onlookers enjoyed the exhibition. The building's lobby showcased an array of paintings, sculptures, photographs, and even origami that represented the artistic elements of scientific endeavours created by faculty, staff and students from UC Berkeley – and several from the EBI, including this one, which shows squeezed ripe fruiting bodies from a cross of two fungus strains, captured by EBI postdoctoral researcher Timo Schuerg. The progeny (Ascospores) are the spherical black objects shown residing in a bag (Ascus). *Art in Science* was sponsored by the on-campus collaborative Science@Cal and this year hosted by the EBI. Included in the exhibition were four talks on various aspects of art's influence on science, and vice versa, including one by EBI principal investigator and plant biologist Louise Glass, who extolled the aesthetic and scientific virtues of 'Neurospora crassa: Portrait of a Fabulous Fungus'. The EBI is studying the enzymes that the fungus produces in its deconstruction of plant material, for clues to one of the key steps in the production of cellulosic biofuel. ■





Safety at sea: a



century of progress

One hundred years ago, the shipping industry introduced its first international convention on safety. Known as SOLAS, the convention is still in use today. To mark the centenary, *BP Magazine* finds out more about this and some of the other important changes that have transformed the safety of shipping oil and gas.

Century of change: the *British Freedom* (left) was built in 1928 in the very early days of the British Tanker Company. In the 1920s, Marconi invented a device that could be fitted to ships to detect radio transmissions from land or other ships, providing a ship's navigator with a bearing line to determine direction. Below, an officer on the bridge of the *British Envoy* now has many more sophisticated electronic navigational tools at his or her disposal.





he sinking of the largest ship in the world – *RMS Titanic* – in the North Atlantic in 1912, with the loss of more than 1,500 lives, was a tragedy that remains part of popular culture a century later. It is remembered in books, films, songs and sayings. Less well known is the legacy for shipping itself – the fact that her dramatic sinking – and the public outcry that followed – prompted the major shipping nations of the world to take decisive action to address the issue of international maritime safety.

The result was the first international convention on Safety of Life at Sea (SOLAS), first adopted in January 1914. It remains in place today as the foundation stone for the many advances made in the business of shipping people and goods safely around the world.

BP Shipping was launched as the British Tanker Company just one year after SOLAS was adopted. Equipped with its own naval architecture and engineering teams, it went on to build one of the world's largest and most sophisticated merchant fleets and to play a part in the development and adoption of many of the most significant advances in oil and gas shipping.

RULES AND REGULATORS

The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships.

It specifies minimum standards for the construction, equipment and operation of ships, compatible with their safety.

The original 1914 version included provisions on safety of navigation, construction, radio-telegraphy, life-saving appliances and fire protection.

However, it was not enough to have a set of rules for a business that touched the seas and shores of so much of the world. The formation of the Inter-Governmental Maritime Consultative Organization (IMCO) in 1948, as part of the United Nations, brought the regulation of the safety of shipping into the oversight of an international body and framework. This framework provided the basis for shipping companies, such as the British Tanker Company and their representative bodies, to work together with governments, regulators and many other stakeholders on setting, measuring and improving standards.

According to Adrian Howard, BP Shipping's vice president of operations, "SOLAS is, without doubt, the most important piece of safety regulation in the maritime industry. It is the ultimate example of an industry sharing and implementing safety lessons learned on a global scale."

IMCO's successor – the International Maritime Organization (IMO) – continues to address issues that include safe navigation, search and rescue, wreck removal, ship recycling, the training and certification of seafarers, and piracy.

POLICING THE WORLD FLEET

Regulation, of course, is ineffective without measurement and enforcement. This was understood back in the 18th century, when so-called 'classification societies' grew out of the ship insurance market to provide reassurance about the condition of ships' hulls and equipment. The societies evolved to 'class' ships as compliant with their specific technical rules and standards, and to routinely survey ships to confirm their continued conformance while in service.

Trial run: the *RMS Titanic* (top) leaves Belfast for sea trials in 1912. It would sink on its maiden voyage from Southampton to New York after hitting an iceberg. The first international convention on Safety of Life at Sea was introduced two years later, as a direct consequence of the tragedy. Bottom left, shipping routes are charted onboard the *British Merchant*. Bottom right, a crew member uses a sextant to aid navigation. Every cadet entering BP today must still learn how to use the more traditional navigation aids.

With the emergence of IMCO, member governments took on responsibility for enforcing the provisions of SOLAS and other conventions as far as their own nationally-registered ships were concerned, and also set the penalties for infringements. But, when an offence occurs in international waters, the responsibility for imposing a penalty rests with the flag state – the country where the vessel has been registered.

In the 1970s, as the shipping industry fell into deep recession, concerns grew that some fleets were being switched from state control to re-register under 'flags of convenience', in countries where compliance with survey and certification duties were considered less demanding and costly.

In 1982, an inter-governmental agreement introduced the concept of Port State Control (PSC). This allowed the inspection of foreign ships in other national ports by local PSC officers for the purpose of verifying their condition and compliance with relevant laws and regulations.

Ship owners and operators also conduct their own regimes for thoroughly inspecting owned and chartered ships. In the 1990s, a voluntary association of oil companies with an interest in shipping, including BP, known as the Oil Companies International Marine Forum, introduced the Ship Inspection Report (SIRE) programme. This provides a database that records each company's individual inspection and auditing of the ships they own, operate, or charter. The database is open to other bodies concerned with vessel safety, such as terminal operators and government bodies. Currently, SIRE holds more than 22,500 reports on more than 8,000 vessels for inspections that have been conducted in the previous 12 months. »





Today, ships face an array of industry, governmental and non-governmental inspections, audits and policing before they take to sea and this continues throughout their marine service.

SEEING IN THE DARK

Knowing where you are and the direction a vessel is headed – especially in darkness or bad weather – is important when you are navigating any kind of vessel. When it's an oil tanker that is the length of more than 70 family-size cars laid bumper-to-bumper, navigational aids are essential.

Navigating by the stars or the magnetic pull of the Earth have been stalwarts of marine navigation for many centuries. Indeed, the humble sextant and magnetic compass remain standard equipment on oil tankers today, where, according to John Ridgway, BP Shipping's chief executive and a former cadet and tanker master, "every cadet entering the BP programme becomes proficient in navigating with a sextant as part of his or her training."

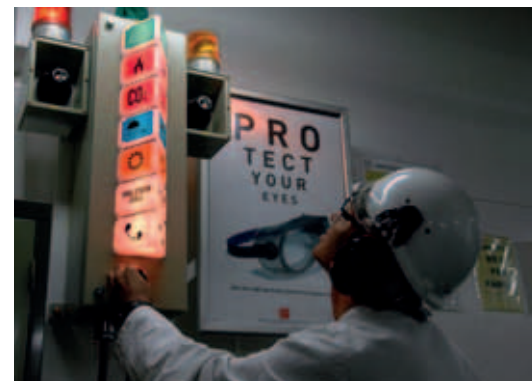
But the past 100 years have seen remarkable advances since the *Titanic* struck an unseen iceberg. The British Admiralty's development of early sonar provided an accurate contour of the seabed over which the ship was sailing. Marconi's

invention in the 1920s of a device fitted to ships that could detect radio transmissions from land or other ships provided a ship's navigator with a bearing line to determine direction. Soon, a network of radio beacon stations was in operation around the world, providing highly accurate navigational information, no matter the weather.

With radio navigation came radar, which quickly became a standard feature on large vessels. Radar is used to measure the bearing and distance of ships to prevent collision with other ships, to navigate, and to fix their position at sea when within range of shore or other fixed references, such as islands, buoys, and lightships. It wasn't long before radar initiated vessel traffic service (VTS) control systems used to monitor and regulate ship movements in some of the world's busiest waters.

By the 1970s, the development of satellite technology introduced navigation by Global Positioning Systems (GPS). This has spurred the introduction of a range of new navigational tools, such as chart plotters, which integrate GPS data with electronic navigational charts, or search and rescue emergency locators. In the 1990s, the Automatic Identification System (AIS) was developed as a technology to avoid collisions between

Safety checks: (above from left), piston inspection onboard the *British Kestrel*; one of the *British Ensign's* life boats; and on the bridge of the *British Chivalry*. Below, safety alarm checks are conducted onboard the *British Envoy*.





large vessels at sea that are not within range of radio systems.

What is remarkable about the bridge of a modern oil tanker today, according to Ridgway, “is the way that the technologies from different ages of maritime history – from the compass to the satellite – are all still in use alongside each other.”

EXHAUSTING EXPLOSIONS

While now relatively rare, the consequences of explosion aboard a tanker can be severe, especially when loading, discharging or cleaning the vessel’s oil and oil product tanks. The widespread introduction of inert gas systems can take much credit for transforming safety in this aspect of tanker operation.

Inert gas systems (IGS) involve the replacement of air and hydrocarbon gases in the space above the oil and oil products in the ship’s tanks, using an oxygen-depleted gas, principally nitrogen and carbon dioxide, which is supplied from either cleaned flue gas from a ship’s boilers or a dedicated inert gas generator. The virtual elimination of oxygen from the tank atmosphere substantially reduces the risk of flammability.

Such technology was not new – it had first found application in oil refineries and

was adapted by the Sun Oil Company in the 1930s, after one of its vessels exploded during tank cleaning. However, it was not until after the Second World War that the work of Dr Charles Sutton and Dr Ken Brummage at BP’s Group Research Centre in Sunbury was instrumental in changing the tanker industry debate, from a focus on eradicating possible causes of ignition onboard to methods of neutralising the gases that could fuel an explosion in the first place.

Convinced of the potential of IGS to protect against explosions and to reduce corrosion in tanks, a full-scale trial was instigated on three BP ships – *British Prestige*, *British Skill* and *British Sovereign* in 1961. The results persuaded BP to take an industry lead and mandate IGSs for all of its new-build ship orders – which it extended to retro-fitting on the entire fleet after an explosion in 1966 on an older tanker – *British Crown* – in Qatar.

BP’s work was soon to broaden into an industry-wide study of tanker explosions, which the British Tanker Company led in association with the Chamber of Shipping. The initiative was to receive the prestigious Samuel Baxter Prize from the Royal Institution of Naval Architects in 1973 and IGS was eventually to become accepted

industry practice and mandatory under IMO regulations.

For Chris Bailey, BP Shipping’s technical vice president: “IGS can be counted among the most important contributions made to safety on oil and gas carriers over the past 100 years. BP patented the work it had completed simply to ensure the design was properly implemented on different ship designs and modes of operation, but, simultaneously, granted its free use to the industry.”

PREVENTING POLLUTION

In 1989, the *Exxon Valdez* tanker loaded with Alaskan North Slope crude oil, bound for Long Beach, California, grounded at Blich Reef, rupturing eight of her 11 cargo tanks and spilling crude oil into the waters of Prince William Sound. No human lives were lost, but the natural losses were considerable.

The scaling up in the 1960s of tankers able to carry hundreds of thousands of tons of crude oil meant that accidents now had the potential to do considerable damage. The loss of the 120,000-ton *Torrey Canyon* tanker in 1967, off the Scilly Isles, had already demonstrated that tanker safety and oil pollution were bound together in a cause and effect relationship. »

DOUBLE HULL SHIPS

A 'single hull' design means that oil in the cargo tanks is separated from the seawater only by the ship's bottom and side plates. A 'double hull' design (as shown here) involves surrounding the cargo tanks (two tanks in this illustration, with a slim dividing section down the middle) with a second internal plate at a sufficient distance from the external plate. The space created between the oil tank and the ship outer side plate is often filled with seawater as ballast. This space protects the inner tanks from low impact collision or stranding.



Torrey Canyon and the resulting International Convention for the Prevention of Pollution from Ships (MARPOL) of 1973 and 1978 brought about directly, if slowly, a host of features to increase the safety of large tankers and reduce the consequences when accidents arose. These included limitations on tank size, structural design for heavy weather, inert gas, improved tank cleaning, traffic control in channels and estuaries, and finally, the total segregation between cargo and ballast in the ship.

But for the oil and shipping industry, *Exxon Valdez* was to represent a new watershed. The US Congress passed the Oil Pollution Act, requiring a phase-out of single-hulled oil tankers in US waters by 2010. IMO requirements for the introduction of double hulling were accelerated in response. Two further oil spills – from the *Erika* and the *Prestige* – in European waters led to changes in EU law and the IMO mandated the phasing-out of all single-hull tankers by 2015.

While the number of large and small spillages of oil from tankers has decreased significantly over the past four decades, *Torrey Canyon* and *Exxon Valdez* remain stark reminders of the need for considerable vigilance in the transport of oil and gas by sea.

PEOPLE AND PROCEDURES

Exxon Valdez was significant for another reason. It underlined the human factor present in many shipping accidents, and the need to ensure that mariners had the right capabilities. A study of claims by a shipping insurance mutual found more than half of all major claims resulted from human error, while one third were related to structural, mechanical and equipment failure. It was clear that only by adopting a fully integrated approach, which established rigour in all aspects surrounding the operation of a ship, could safety be deeply embedded within the industry.

In 1993, the International Management Code for the Safe Operation of Ships and for Pollution Prevention (the ISM Code) was introduced. It established safety-management objectives and required a safety management system (SMS) to be established by the ship owner or any person who has assumed responsibility for operating the ship.

The ISM Code requires commitment from the very top levels of management, a clear set of policies and established procedures for what is done onboard the ship, during normal operations and in

emergency situations, and for conducting both internal and external audits and implementing corrective procedures to ensure the ship is operating in accordance with procedures. Perhaps most significantly, a designated person ashore (DPA) is now appointed to serve as the link between the ships and the most senior management ashore and to verify the SMS implementation.

Each ISM-compliant ship is audited, first by the company and then every two to three years by the flag state. Once SMS is verified, and it is working and effectively implemented, the ship is issued with a Safety Management Certificate – critical to its licence to operate within the industry.

For BP Shipping's Iain Bruce, health and safety manager and DPA: "There is a close synergy with the BP operating management system (OMS), which provides the basis for managing operations in a systematic way. We can bring useful insights from more than a decade working in compliance with the shipping industry ISM Code, which has now established a common standard for operating excellence and underpins the modern oil and gas shipping industry." ■

Lifesaving equipment:
onboard one of the British
Kestrel's lifeboats.







A great advertisement

With its support for disadvantaged schoolchildren and unemployed men and women alike, BP South Africa's Ads for Bags programme is proving that sometimes the simplest ideas are the most effective.



Enormous billboards have become part of the urban landscape. And after a glance at the latest image of David Beckham in his underwear, many probably don't give a second thought to how they got there or what will happen to them when they're replaced.

Yet, BP employees in South Africa have found an original way to turn advertising hoarding material into a force for good: by turning them into school bags.

"The material is made from vinyl, which is not only sturdy and waterproof, but is also pliable, therefore easy to cut and sew," says Renny Letswalo, head of retail for BP South Africa's fuels value chain, who came up with the idea. It's perfect for school bags and in abundant supply.

BP alone has 27 outdoor advertising sites in South Africa, which, in one year, can use more than 100 billboards. Each are dressed with see-through vinyl weatherproofing covers – known as 'skins' – throughout the year for campaigns lasting three months at a time. Ordinarily, this vinyl is discarded once it has served its purpose, either stored in warehouses, buried in a landfill or incinerated. Letswalo spotted an opportunity to create a project that simultaneously tackles BP's industrial waste and serves the local community.



“Every year, we produce advertising billboards made of vinyl,” says Letswalo. “Instead of throwing them away and filling up landfill, we thought it would be great to do something useful with them.”

Ads to Bags, as the programme is called, reuses the tonnes of hardwearing fabric waste, turning it, instead, into colourful school bags, pencil cases and chair bags for thousands of disadvantaged schoolchildren in South Africa. Reams of vinyl are delivered to community centres, where semi-skilled but unemployed men and women transform them into bags.

South Africa sits in an awkward economic category, between developing and developed. Although there has been substantial economic advancement, many still live in trying levels of poverty. Education is a challenge for many families, who often can't afford the ancillary equipment their children need for school. Reading books are shared among pupils, writing equipment is limited to a solitary

pencil, school bags extend only as far as an old carrier.

“From a personal point of view, there's a teacher in me that just wants to see kids prosper,” says Letswalo of her motivation, “to know that there are kids out there who go to school every day without the basics is painful. I'm a mother, too, and seeing what my kids have at school and knowing that many less fortunate children don't have the same basic tools is a real driver for me. It's great to be able to do something about this.”

Selected schools

BP selected four schools for the first Ads to Bags donations in South Africa's three major cities: Makhoarane Primary School in Soweto, Johannesburg; Sukuma Primary School in Umlazi, Durban; Boekenhout Primary School in Johannesburg; and Injongo Primary School in Khayelitsha, Cape Town. Subsequent donations have been made to additional schools nominated by BP employees.

Pexie Jafta, principal at Makhoarane Primary School, one of the first to benefit from the Ads to Bags programme, says: “Most families in the area are unable to provide basic supplies for their children. The government supplies us with stationery, but the students don't have bags, uniforms and shoes. The BP backpacks, pencil cases and chair bags will make a difference to the kids' lives.”

For the women in the community centre, too, the programme has been transformative. Channelling production through the centre is having a positive ripple effect on skills development within the out-of-work community, as they learn how to repurpose the material. Doreen Tokwe – Mama Doreen as she is affectionately known – began working out of the Ekukhanyeni Community Development Centre in Johannesburg. Her daughter suggested that she apply to the programme after learning that BP was searching for people with sewing expertise. »



Funding from BP allows her to employ local people at a modest wage. At the peak of production, the project has allowed her to create around 38 temporary jobs, given her enough money to purchase seven new sewing machines, increasing capacity, and allowed her to set up her own sewing and manufacture establishment in the city.

“It helped a lot of people who were not working,” says Tokwe. “I showed them how to cut the material and how to sew the bags. Many of the ladies are over 50 and it’s not easy to get a job. This job brings bread to the table.” What’s more, she says the project has given her confidence. “It gave me the guts as an old woman to start a business. BP gave me a chance.”

“It’s a simple idea, but there are multiple benefits,” says Letswalo. “The kids get supplies, the women gain employment, the vinyl doesn’t end up in a landfill or incinerators, and BP is recognised as being in tune with the community.”

The programme, launched in 2013, has so far delivered more than 8,000 bags, 8,000 pencil cases and 8,000 chair bags. It has been very well received, generating positive feedback in the media, community, and from peers. It also won the 2013 ‘excellence’ Helios Award in BP’s annual employee recognition programme. Internally, it has galvanised BP employees, uniting a broad spectrum of colleagues in a common cause and serving to integrate the company further into the region. “The response has been truly heart-warming,” says Letswalo.



“The kids get supplies, the women gain employment, the vinyl doesn’t end up in a landfill or incinerators, and BP is recognised as being in tune with the community.”

Renny Letswalo

Finished article: so far, more than 8,000 bags, 8,000 pencil cases and 8,000 chair bags have been delivered to children at four South African schools.

Having found such success, Ads to Bags is being expanded, and methods for sustaining the project in the long term are being explored. In phase two, other corporations have been encouraged to donate their outdoor vinyl to create a larger supply of raw materials. “We’re quite optimistic it will sustain itself,” says Letswalo. “We hope that this will become an annual project and that we can reach even more than the 8,000 pupils who received bags in 2013.”

Six companies have already committed to contributing material, both local businesses and multinational companies, such as Chevrolet and Renault.

Wider support

Black Brain is a South African multi-media communications and production company. It has donated enough resources to produce more than 1,000 units of each item, in addition to staff hours to administer the project. Sales and marketing director Thato “TT” Mbha says the company was only too pleased to get involved. “We as Black Brain members were all raised in the Soweto township community where the principle of Ubuntu was drilled into our DNA. The saying ‘umuntu ngumuntu ngabantu’ – you are who you are because of others – is something that we always carry with us in both our business and social dealings.”

Boekenhout Primary School received bags as part of the second wave of donations, where 1,300 students were given new equipment. As well as supporting children, it’s radically changing relationships between corporation and community. The school’s principal, Mr Marnewicke, says: “This scheme has improved our impression of big businesses. It shows that a big company like BP can come down to the grass roots and touch the people that contribute to the company’s success.”

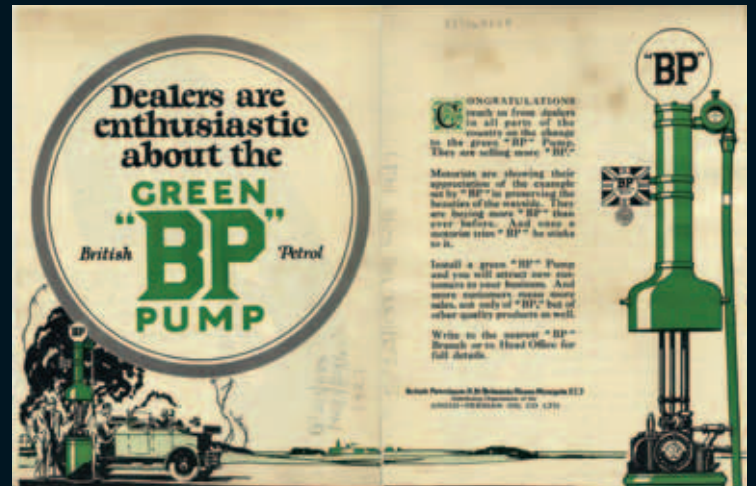
Letswalo says: “Ads to Bags shows BP as a good corporate citizen that listens to and understands the needs of the community we operate in. From a business perspective, at the heart of what we’re trying to achieve is to further establish ourselves as a brand and a business and drive brand preference to our sites.

“We’re also helping to address one of the biggest social problems in this country, that of children attending school without the required school supplies. We can’t solve it, but if we all play our part, it will make a difference to thousands of children’s lives.” ■





Left: a BP service station in Athens, Greece, with the familiar BP shield and green and yellow branding. **Below:** a 1927 advertisement encouraging dealers to install a green BP pump. British pumps began to go green after a public outcry at the garishness of the traditional red pumps. It was thought the green better preserved the natural beauty of the countryside. Other adverts from the time declare that customers are 'flocking' to the new BP pumps because "they appreciate the public spirited action of the Company in helping to preserve the amenities of the wayside and because they know that they get the best all-round results from "BP", the British Petrol."



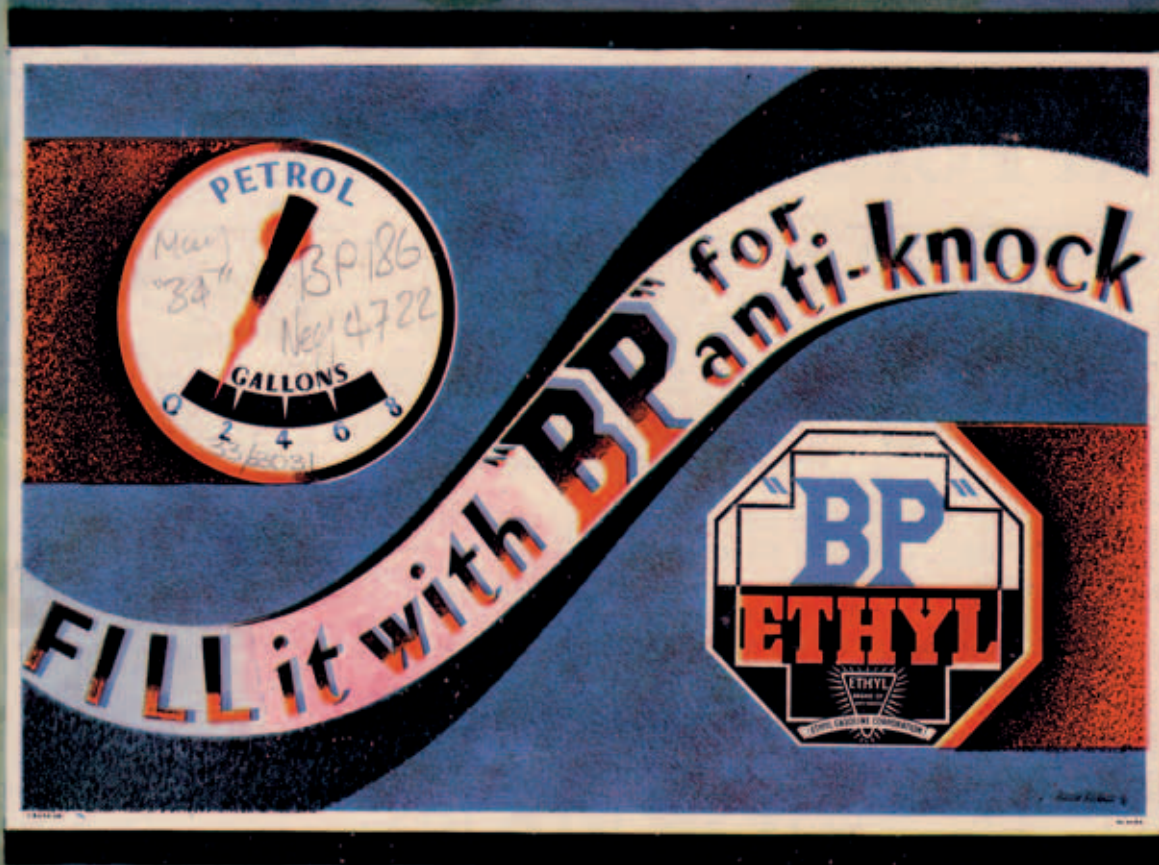
GOING GREEN

It's 90 years since the colours green and yellow were first used in BP marketing materials in France. It is said two executives thought the colours reflected their Spring-like mood following a lunch just outside Paris. Three years later, petrol pumps in the UK began to go green as well. We open up the archive and take a look at some of the ways in which the BP brand has developed in that time.

SPECIAL WHITSUN NUMBER

3RD

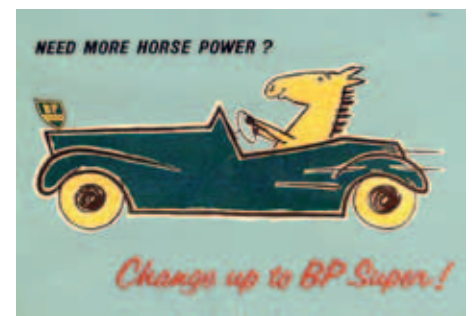
The Light Car



Above: in 1931, BP decided to formalise its 'house mark' (brand). It consisted of the BP letters in quotation marks sat inside the outline of a shield. This formalisation didn't occur right away, though. This advertisement for BP Ethyl appeared in 1934 and, although the quotations are in place, the green and yellow shield is not.



Left: another advertisement, this time from 1929, urging dealers to switch to the green pump in order to see their sales go up. **Below and bottom:** many old BP adverts were designed by celebrated artists. These two, promoting BP Super, was produced by distinguished French poster artist Savignac. He found fame for his humorous yet simple style. Both adverts were part of the first 'modern' advertising campaign after the dissolution of wartime pool petrol for BP. The company used all media opportunities at its disposal – radio, newspaper and the new technology of television.



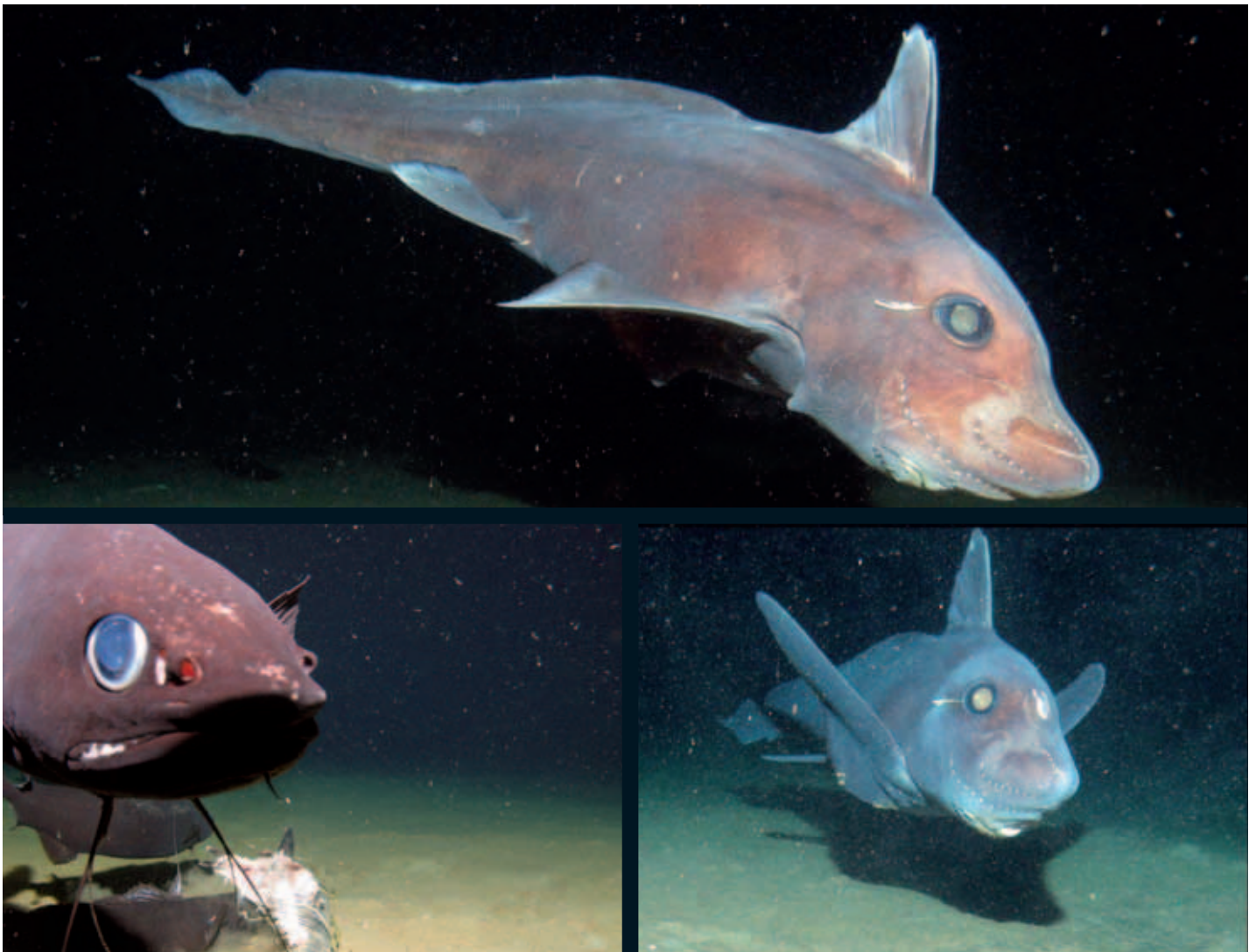


Left and below: all examples of BP's well-known green and yellow shield advertising from around the world (the service station pictured bottom left is located in Vietnam). Small changes occurred over time – the green shield on a white background was in use from 1958 until 1989, when it switched to a fully green background with a yellow shield outline.



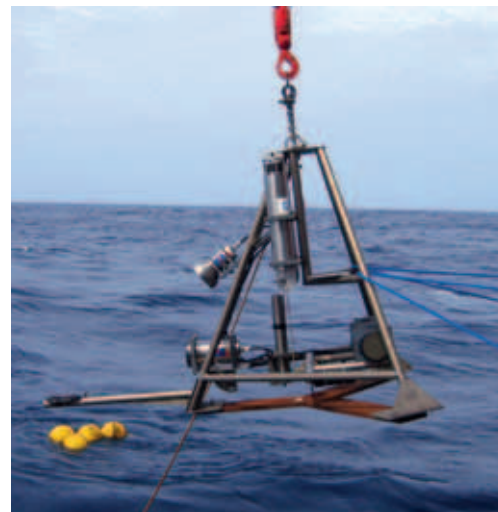
Left: the brand today. Following the merger with Amoco and acquisition of ARCO, BP decided it needed a new brand to reflect a new company. The green and yellow helios was born and can still be seen at its service stations, on the side of road tankers and in advertising right around the world.

Photography > ROBIO



Ocean life

The above images were captured using a device created by BP and the University of Aberdeen's Oceanlab and show a Chimaera fish (top and above right) and an Antimora fish (above left). Built to BP's specifications, the ROBIO – which stands for robust biodiversity – lander (right) was designed and built to photograph the diversity of marine species and helps BP gather marine data around possible subsea oil and gas exploration and development sites as part of assessing potential environmental impacts. The ROBIO method causes no harm to deep sea wildlife and can be tethered two metres (6.5 feet) above the seafloor with the camera pointed directly towards bait that attracts a huge range of scavengers. Alternatively, ROBIO can be landed on the sea floor with the camera directed outward acquiring time-lapsed images of the sea creatures. The surveys are carried out to support BP's environmental management activities, providing a baseline against which future change might be gauged. To see more images like this, visit www.bp.com/bpmagazine.



The next edition of *BP Magazine* will be out in November 2014.

BP Magazine was printed using vegetable based printing inks and low alcohol damping on press. The FSC® certified paper was manufactured using 50% de-inked post consumer waste fibre and 50% virgin fibre pulp sourced from well managed forests at a mill accredited for EMAS, ISO14001. Laminated using Biodegradable film



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It's not about the cards you're dealt, it's how you play them.

Here's to the athletes who proved that anything is possible. They didn't just keep going, they went further and became an inspiration to us all. None more so than London 2012 Paralympic silver medallist – and world record holder, Matt Stutzman.

In light of such displays of courage and determination, we are delighted to support all Paralympians as they continue to inspire every generation.



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