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TECHNOLOGY

WELCOME

Our ability to identify, develop and implement technology is critical to our success both globally and regionally.

We are perhaps overly critical of our ability to apply technology and, yes, there is scope to be better. Nevertheless, I think we have seen dramatic improvements over the past two or three years in terms of finding a balance between pushing new technology from the centre and the pull for new technology from the engineers and managers at the sharp end in charge of projects.

Actually, 'good' technologies - where the production and financial benefit are immediately obvious - don't need a lot of push. Others though do have potential but don't show an immediate response and these do need a bit more push and experience shows that sometimes perhaps we haven't pushed them as hard as we should, for example with 4D seismic when it first emerged.

On the other hand, within Europe UBD would never have been as successful as it has been without a significant amount of push. These are the sort of technologies that need champions and technology co-ordinators to make them work.

My role and that of my colleagues in the Technical Directorate is simply to safely develop as much new, cheap oil and gas as possible. In some parts of the world that means standardising production methods but within EPE that model doesn't necessarily work. The varied nature of our business and its maturity means that a degree of customisation is necessary and that creates a breeding ground for technology, especially new technology.

I need to have a sympathetic ear and to encourage and foster the development of that technology but I am also prepared, on occasion, to challenge its use and costs and to ask pertinent questions such as 'will it work?' and 'will it increase production?'!

Looking for opportunities to use new technology is something that all project staff should be aggressively considering. Very often Shell is at the leading edge, but not always. Project leaders and engineers need to keep their eye on what is happening elsewhere across the Group and within the industry so that we can take advantage of new developments to help us lower costs and increase volume.

In fact, without applying new technology it will be very difficult to achieve those two objectives and without so doing our European business will simply not be sustainable. That is why the use of technology is so critical to our future.

John Gallagher

Successful trial of wireless monitoring at Nyhamna gas plant

One of the GE wSIM wireless monotors in position at the Nyhamna gas plant in Norway

Shell has successfully trailed the use of wireless vibration and temperature monitoring at the Nyhamna gas plant in Norway. The system means that much greater numbers of monitoring points - many in hazardous areas - can be regularly monitored and so help the plant maintenance engineers identify potential system breakdowns in advance.

Shell Global Solutions R&D engineer Sicco Dwars pushed this technology through its incubation phase. EPE's Michiel Molenaar then spotted the fit for it in the Ormen Lange project. Backed by the enthusiasm of Graham Baird, condition monitoring engineer at the Nyhamna facility, the team managed to persuade GE Energy to realise and commercialise the fit for purpose pilot solution that's now operational.

Unexpected shutdowns of rotating equipment are the main contributor to production shutdowns. Very often plant maintenance engineers are pushed into 'breakdown' mode instead of doing planned maintenance activities because, typically, only the most critical rotating equipment is continuously monitored.

But the development and introduction of the wireless network technology - now being marketed as the GE wSIM system - has proven very successful in the recent Nyhamna trial and opens the way for Shell to remotely monitor hundreds or even thousands of points on a plant, thus significantly reducing lost production.

The pilot installation of 18 sensors

Continued on overleaf

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monitors the condition of pieces of rotating equipment at Nyhamna. This pilot was managed and supervised by Graham Baird.

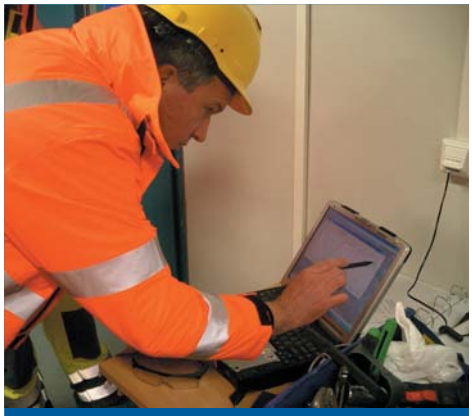
"Normal practice would be for Graham to check these points once a week or even once a month," says George Zolkiewski, another team member from the global rotating equipment discipline in The Hague. "He would record the data manually, with a handheld tool, or even simply by listening and watching.

This is time consuming; most time is actually spent walking on site from machine to machine - and helicoptering onto platforms. The engineers do not have the time to check as many places as they would like, never mind the fact that some of the places they might want to check are difficult or even dangerous to get at."

As a consequence this leads to a conservative approach being taken at the design stage, with spare plant backup equipment being ordered, something that increases the original cost of the plant.

With the new sensors, engineers can pick out any change in the vibration frequency pattern, with measurements taken at intervals from every five minutes to every six hours, depending on the equipment and their requirements. If abnormal changes are detected, they can analyse this further, identify potential problems before they occur, and change out necessary components before they create a risk for the plant availability.

Two important elements of the technology are the availability of battery-less power supply and mesh wireless technology.



Sicco Dwars

"A self-generating power supply is important because batteries have a limited life, particularly when they are required to work outdoors, with temperatures spanning from tropical to arctic conditions," explains Sicco.

Shell worked with a UK company, Perpetuum Ltd, to develop vibration energy-harvesting micro-generators to power the wireless sensors that report temperature and overall vibration every five minutes and a full frequency spectrum every six hours. These sensors are designed to keep delivering data for up to 20 years.

The other important technology is mesh wireless networking, where the sensors sit in a network where they both receive and transmit data, not just from themselves but also for other sensors in the network. Each sensor thus helps nearby sensors to forward their information stream, either to another sensor or the main receiver so that the main receiver doesn't have to be positioned where it needs a reliable signal from every sensor on the network. Additional repeater sensors can be added to the mesh, strengthening the robustness of the mesh.

"The requirement that we identified in 2005 to develop a sensor technology that could be retrofitted in our brownfield sites, a technology that is modular, easy to install, open industry standard, has a low unit cost and a low maintenance cost, has been achieved," conclude all in the team, "We anticipate that use of wireless in-plant technology will be standard practice around the world within a few years."

For further information regarding this technology e-mail:

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New system will improve environmental risk management

Norske Shell has been at the forefront of an industry wide development over three years to develop the Environmental Risk Management System (ERMS), a new tool that expands the use of the existing Environmental Impact Factor (EIF) management tool for quantifying potential environmental risks in produced water discharges to include the environmental risks from drilling discharges.

ERMS was a joint industry project with participants from Norske Shell, StatoilHydro, ConocoPhillips, Total, Petrobras, ENI and ExxonMobil, together with a number of research partners.

"The whole point about ERMS and, indeed, EIF is improving the quality of the decision-making process concerning discharges to the sea," says Anne-Mette Hilmen, the R&D co-ordinator Shell Technology Norway AS.

"Whilst there are already strict regulations concerning discharges to the sea, particularly in the Norwegian and UK sectors, the environmental focus on our industry will undoubtedly increase and future regulatory requirements will inevitably be stricter and more complex.

"Those future regulatory requirements are likely to have an increasing number of parameters and, of course, where we wish to explore and produce in environmentally vulnerable areas the level of discharges that we may be allowed to work within will be significantly lower than the demanding targets we already have."

Anne-Mette goes on to say that ERMS will enable managers to make informed decisions regarding both produced water and drilling discharges by having this tool. "It quantifies the environmental risk, i.e. the volumes of water in which the ratio between the environmental concentration and the tolerance level of the environment exceeds a value of one," explains Anne-Mette. "The EIF takes into account both composition and amount of the discharge, location of discharge, currents, winds and other factors.

"ERMS can produce figures in advance that allow a manager to compare the predicted outcomes of various technologies. For example, with produced water you could use the system to look at simple reinjection, a combination of reinjection and water polishing or just different water polishing options on its own.

It would then be easier for the manager to make the right choice in terms of the combination between environmental risk and cost so that a combination of the most economic and environmentally appropriate solution can be chosen."

The new ERMS tool is already available and is expected to make a significant contribution in helping Shell maintain their ISO14001 environmental impact certification.

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Shell developed technology becomes commercial success

A Shell developed technology first thought of only in 2000 to answer a water sealing problem in Oman has been spun off and is now a commercial success, being sold throughout the industry around the world by a company, Swellfix, that is part owned by Shell and that has offices in the UK, Europe, the Far East, Africa, the USA and the Middle East.

The technology, swellable packers, was developed by Rick Madeiros and Roger van Noort of Petroleum Development Oman, together with Thijs Baaijens of SIEP, to handle water ingress from formations. The Shell research laboratory very quickly developed swellable elastomers that, on their first test, reduced the amount of water coming from the well from 90% to 10% and, indeed, by 2002 over 160 packers had been run.

The technology uses a rubber material that, when placed in certain fluids, such as water, drilling mud or oil, expand and create a seal between the casing and the formation. The elastomers can be vulcanised as gaskets directly onto the steel pipe or applied on slip on sleeves.

John Dewar, Swellfix's managing director - and previously Shell's head of research - takes up the story. "After the first success in Oman, the guys out there used the technology on a further 11 wells with the result that one million barrels of oil were added to production within the first 12 months.

"Over the next couple of years there was considerable discussion within Shell about how the technology should be taken advantage of. There had been a couple of different models that have been tried in terms of commercialising new technology that Shell had developed. On this occasion it was decided that the most advantageous way forward was for Shell Technology Ventures (STV) to create a separate company and thus Swellfix was formed in January 2006. Later, a proportion of the shareholding was sold to other venture capitalists.

"By the end of 2007 we had 29 people working for the company and now, early in 2008, we are in the process of recruiting in excess of 20 further staff and our target for this year is a growth of 400%."

Pictured (left) is Erik Cornelissen to whose purchase of a toy dinosaur for his nephews led to the use of swellable elastomers for the oil and gas industry. The dinosaur grew several times when dunked in water. "I bought it for less than a dollar and walking out of the shop realised it could have potential for the oil industry," Cornelissen said. On the right of the picture is John Dewar, Swellfix chief executive.

In the three years since the successful Omani applications of the original product (E-ZIP) the range of swellable packers has been expanded so that there are now eight different zonal isolation profiler (ZIP) products, all using the swellable elastomer technology.

As well as the original product for zonal isolation for water shut off, there are now products to fit expandable tubulars (X-ZIP), as a scab liner run inside an existing liner (I-ZIP), and for providing pressurised seals around the casing to eliminate micro-annuli (C-ZIP).

99aA - E-ZIP following heat treatment awaiting inspection.

There is also a version of the product that allows for the provision of control lines for use in smart well completions or to isolate branches of multi-lateral wells.

"We now have over 2,500 available elastomers of which we have conducted detailed tests on about a hundred and we now select the appropriate elastomer specifically for each well application," says John.

As well as a wide variety of applications for operators in Russia, Norway, New Zealand, the USA, Brunei and Malaysia, Shell companies around the world are also making use of the technology.

For example, Salym Petroleum Development (Shell/Sibir JV) has been running two or three Swellfix C-ZIP products in selected wells in Russia for prevention of inter-zonal fluid flow when micro-annuli of cemented liners are created. These were previously run with other sealing mechanisms to reduce the likelihood of micro-annulus formation but it was thought that the C-ZIP would provide a better longer term seal. The C-ZIPs provided have water swelling elastomers that are designed to swell in the water based mud used to drill production intervals.

In Nigeria on Shell's Gbaran-1 onshore gas field, E-Zip packers were successfully used for zonal isolation above expandable sand screens. After installation a final seal was achieved within 44 days and the condensate in the gas produced during normal operations will keep both the oil and water elements of the packers swollen at the their optimum level for the life of the well.

John Dewar concludes by saying that swellable elastomer technology and the way Shell has successfully worked with others to set-up Swellfix as a spin-off company is a good example of how emerging technologies can be taken advantage of. "Shell wins because the technology can be developed faster and at less cost than by keeping it completely in-house and the rest of the industry - and ultimately society at a whole - wins because the technology becomes available to other operators."

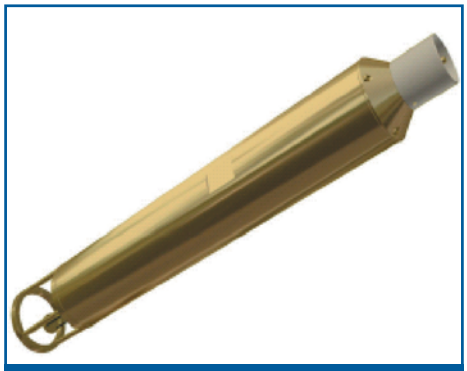
For further information regarding this technology e-mail: garron.lees@swellfix.co.uk

Seafloor geodesy project

A new seafloor geodesic technique that will provide reservoir deformation monitoring significantly more accurate than previously available through conventional seismic survey is being tested in the Ormen Lange field off the coast of Norway and in the Jintan field off the coast of Malaysia. The new technology can also provide the results in a much shorter time and for a fifth of the cost.

The technology uses proven, commercially available Sonardyne Compatt acoustic sensors, albeit re-engineered to provide at least three years monitoring without maintenance. The Ormen Lange test started in September last year with a ten sensor network in 1,000 metres of water while the Jintan test that started a month later involves a 10 sensor network with a further similar number planned to be installed in the spring of 2008.

Paul Hatchell is one of the EPT-R reservoir surveillance engineers involved in the project.



The Seabed Monitoring Transponder (SMT)

"In the case of Ormen Lange the reservoir simulation models predict that seafloor subsidence would be in the order of 2-25cm after the first two years of production with a similar magnitude of horizontal displacement of the seafloor also expected," says Paul.

"Seismic monitoring would not be expected to deliver reliable results until 15cm of reservoir compaction developed and this could take up to five years.

But the new system is anticipated to provide horizontal strain measurements as accurate as 1cm per kilometre and subsidence to an accuracy of 1cm."

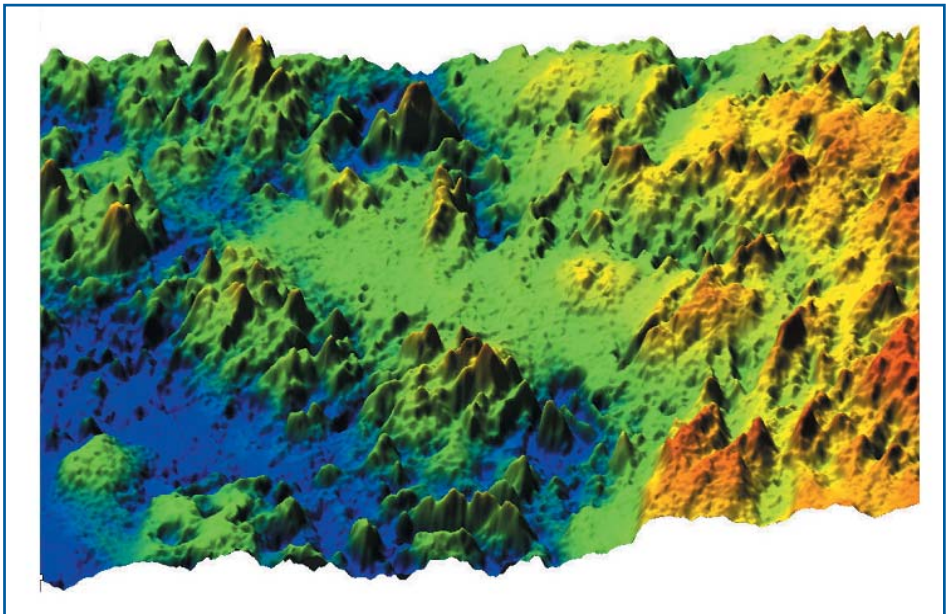
The trials are being managed jointly by Shell's global Geomatics department and EPT-R reservoir surveillance with Geomatics handling contract management for engineering and development of technology, execution of deployment operations, management of operational HSE, array network design and data acquisition and processing.

SV Geofjord – Deployment vessel at Ormen Lange

About 70 days of data has been successfully recovered to date from both trials. Early indications are that the raw repeatability of the ranging data at the Ormen Lange field is exceeding expectations.

It is the intention that if the trials are a success, Geomatics would provide a full global service for the future but the close involvement of EPT-R with these two trials has opened the door for Geomatics to accelerate the deployment of a number of other time-lapse reservoir surveillance technologies.

For further information regarding these trials e-mail: paul.hatchell@shell.com



Complex seabed topography at Ormen Lange was a big operational challenge to overcome

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