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Are we all data managers?

As I write this, I'm on holiday in Barbados for 3 weeks - a great place to relax and do some thinking!

It's said that a former CEO of my previous employer once spent a similar amount of time here re-writing all of the company's 'governance' rules on realms and realms of A4 paper.

I can't claim to have such profound thoughts but I have been thinking about what the mainly technical oil and gas professionals who are our Finding Petroleum/Digital Energy Journal/OilEdge audience actually do when they're at work!

I concluded that, for many of them and to put it very simply, they collect and organise the data they need, apply their specialist skills to analysing and interpret it, and then work in a team - to deliver a basin-wide petroleum system review or build a prospect inventory or select a well location or define a field development plan or predict field reserves/production, and so on.

The big data problem
Whatever we are trying to do, we are confronted with potentially vast amounts of data.

For a frontier basin, we may have remote sensing images from satellites, national archives, academic literature, seepage data, regional magnetic and gravity maps, some 2D seismic or, if offshore, huge 'regional' 3Ds. If we are lucky, some reliable well logs.

For production forecasting, we will have the projection or injection history from several wells, including down hole meters, several/many reliable well logs and cores, 24/7 recordings from 'whole well' fibre optics, time-lapse seismic (from towed streamers or permanent monitoring), simulator outputs.

Whatever we are doing, there could be a "Niagara Falls" of data, some or all of which has to be analysed and interpreted.

Analysis and interpretation:
There is a multitude of software which specialists use for geochemical analysis, log interpretation, interpretation of acoustic signals on fibre optics, interpretation of seismic for 'static' reservoir description, interpretation of seismic attributes for reservoir 'dynamics', interpretation of interference tests, decline curve analysis, simulation and history-matching. Some of these applications can even 'talk' to one another!

Team working
To pursue a theme I have mentioned before, I have been on many team-building courses in my career but have noticed that teamwork in our industry, where there are many distinct disciplines that must contribute to an exploration venture, a field development project, a 'debottlenecking' exercise or a field resurrection programme, works best when everybody is looking at the same thing.

Courtesy of my son, who bought me for Christmas a year or so ago a book entitled "Enterprise 2.0" by Andrew McAfee (sub-titled "New Collaborative Tools For Your Organisation's Toughest Challenges"), I've learned that the simple idea I express above lies at the heart of what McAfee christened Enterprise 2.0.

He asserts, thanks to a new class of collaborative technologies, companies can perform as an integrated whole to tap into innovations and good ideas, first capturing and then deploying the collective know how of their employees.

My favourite collaborative technology has always been visualisation because of the profound effect I have seen it have on subsurface work – geoscientists, reservoir engineers, petrophysicists, drilling & completions engineers working together.

However, there are clearly a lot more technologies 'out there' and thus I am always excited by our Finding Petroleum “Collaborative Technologies” Forums or my own visits to “collaboration centres”, and I always assume everybody else sees them positively too.

3 layered pyramids
However, if you accept my simplified arguments above, oil and gas professionals habitually work in what we can think of as 3-layered pyramids, working upwards from a broad base of data, through analysis and interpretation in the middle, to team working at the top.

This is true whatever we are doing. And doesn't it then follow that we at Finding Petroleum should organise many of our events and articles around the respective 'pyramids' for Exploration & Appraisal, Field Development, Production Management and Drilling?
Digital Energy Journal events

Developments with the digital oilfield
Making digital technology work
London, 04 Dec 2012

Improving supply chains decision making
Keeping complex supply chains under control
Stavanger, 27 Feb 2013

Improving decision making with subsurface data
How can we make better decisions with subsurface data - with better analytics and data gathering?
Aberdeen, 19 Mar 2013

Improving decision making for managing offshore assets
Making the best possible decisions about how to manage offshore assets
Aberdeen, 20 Mar 2013

Improving decision making with subsurface data
How can we make better decisions with subsurface data - with better analytics and data gathering?
Stavanger, 16 Apr 2012

Improving production decisions
Stavanger, 18 Apr 2013

Improving IT / IM infrastructure decisions
Stavanger, 19 Apr 2013

Making better plant design decisions
Aberdeen, 21 May 2013

Drilling data - making it easier to make decisions with
Aberdeen, 23 May 2013

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Are we all data managers?


Areal Monitoring of the reservoir
Shell is developing ways to make it easier and faster to implement permanent reservoir monitoring systems

BP’s field of the Future - moving to phase 3
BP’s Field of the Future project is now moving to its third phase, which is getting everything implemented and integrated, says Steve Roberts, who leads the program

Integrated operations at Ekofisk
ConocoPhillips Ekofisk field, offshore Norway, is one of the world’s leading fields with integrated operations. Ole Klingsheim explains how it works

Statoil’s view on IO
Øystein Michelsen, executive vice president, Development and Production Norway, Statoil, is impressed with what integrated operations has achieved for the company

IO - getting it implemented
A discussion at the Trondheim Integrated Operations conference covered different configurations of IO, how much to standardise processes, how best to integrate suppliers, the difference between standardisation and governance

Learning from Healthcare
Professor Samer Faraj, Canada Research Chair in Technology, Management and Healthcare at the Desautels Faculty of Management at McGill University, Montreal, talked about his studies of staff working at hospitals dealing with emergencies, and how the oil and gas industry might be able to learn from that.

Can we be more flexible?
Do we design facilities assuming that we know more than we do, asks Andrew Gibson

Sharing knowledge about facilities operations
Plans are underway in Norway for a centre for sharing knowledge about facility operation

PIDX Autumn Europe meeting, London, October 17 2012

E-commerce standards - aiming too high?
Are e-commerce standards hard to implement in the oil and gas industry – because people are trying to make them too perfect? Our report from the PIDX Autumn Europe meeting in London on October 17

Getting suppliers on-board
Angie Marquardt, Western Hemisphere procurement manager for BP’s refinery and marketing business organisations, has recently been involved in a project to improve ‘supplier enablement’ at BP, or in other words, getting suppliers more integrated with BP’s procurement systems.

Subsurface

Geofacets - search geological papers by map
Geofacets from Elsevier, an online tool for searching academic geological content, now includes papers from more professional societies

Drilling and production

Making more from Well data
How do you do more with the data you have, to help manage the safety and integrity of your wells? By Dr Liane Smith of Intetech

Managing software on new drilling rigs
As control software on drilling rigs gets more complex, it gets more important to have a formal ‘management of change process to follow when the software needs to be changed. Stephen Hadley and Christopher Goetz of Kingston Systems explain how to do it

Cleaning frac water with electrical pulses
Cleaning up frac water is a major expense in fracking jobs - but OriginOil of Los Angeles believes they have found a lower cost way to do it

The Digital value engineer
Upstream clearly needs competent professionals who can take an operation to higher levels of performance using petroleum engineering, IT and business savvy, writes Dutch Holland
Areal monitoring of the reservoir

Shell is developing ways to make it easier and faster to implement permanent reservoir monitoring systems.

Take-up of reservoir monitoring solutions is still slow, mainly due to cost, says Peter Engbers, Smart Fields and Areal Reservoir Surveillance Global Deployment Lead with Shell, and a past Head Quantitative Seismic Interpretation at Brunei Shell Petroleum.

Technologies for monitoring reservoirs while they are producing, including 4D seismic and seabed fibre optic cable, have been available for many years.

But when it comes to seabed permanent fibre optic recording for areal reservoir surveillance, you can count the number of implementations “on one hand”, he reckons.

He was speaking at the Integrated Operations conference in Trondheim on September 25-26.

Shell uses the term “areal reservoir surveillance”, for monitoring reservoirs while they are producing.

But you can reduce the costs by keeping the reservoir monitoring systems over a smaller area of the seabed, where they can provide the most value, he says. “We can focus on where it is needed,” he said.

“One obvious place is in a water flood, when we are injecting. We basically need to visualise what is happening around the injector, where is the water going.”

“We don’t need to monitor the whole field if we are injecting in a few wells. We just have to monitor a few kilometres around it.”

Shell is developing ways to get a range of areal reservoir monitoring tools deployable in 5 months.

“The whole idea is to have a flexible system which we just put there when we need it,” he said.

Shell has a name for the system – “4D”, which means “Innovative, inexpensive, intelligent and instantaneous,” he said.

“We basically measure everything in an instantaneous way get the results within days on your workstation. That’s more efficient, faster and cheaper. That’s what we see as a future way for a lot of particularly water flood fields.”

“It’s a real qualitative use of the 4D seismic data.”

So far Shell has 80 fields covered with different types of 4D seismic.

“That’s about a quarter of all the fields in the whole of the Shell group,” he said.

“Most of them are already the fields where we think this is making sense. We are going very far to what we feel is our applicable base.”

“By the end of 2014 we will have covered all our offshore water flood fields with 4D seismic.”

Benefits

The biggest reason for areal reservoir surveillance is that reality is often different to what reservoir models predict. “There are always unexpected things,” Mr Engbers said. “The reservoirs all behave differently to our reservoir models.”

Where the 4D data has been gathered and integrated with reservoir models, the reservoir models typically show much more heterogeneity (mixed-up-ness), he said. “So it is much more realistic and therefore much more accurate for helping position wells.”

Reservoirs might turn out to be a different shape to what was previously thought. “We don’t know much about how reservoirs will drain and how fluids will flow around them.”

By having a better understanding of the reservoir, you can improve your plan for where you want to drill wells in future. You can also use it to monitor how well any improved recovery methods are working (such as water flood) and see if they can be improved.

It can also help improve safety. “More and more detailed information can tell us about unexpected fluid movements, maybe out of zone, out of zone fracturing or leakage of gas, and making sure we are injecting safely,” he said.

The information generated is useful to people working on a several month to several year time scale, who are in charge of well and reservoir management, and field development, he said.

Reservoir engineers usually do history matching, matching the actual data with the data the model predicted. But this is only usually done with production data, not reservoir data. If you continually monitor the reservoir, you can do history matching for the reservoir.

“All areal data is automatically used to constrain your reservoir model,” he said.

It would be good if it could work on faster time scales, to support production optimisation and real time operations, he said, integrating the data with a dynamic reservoir model.

Technologies

Areal reservoir surveillance can involve a large range of different technology solutions, he said, but 4D seismic (taking repeated seismic surveys of the field to see what has changed) is “the most specific and detailed way of working out what’s happening there.”

Other methods include seabed fibre optic (see below), microseismic, passive seismic monitoring, borehole seismic measurements, time lapse magnetics, time lapse gravity, time lapse geodesy (small changes in the earth’s shape). These can be used together with 4D seismic, or when 4D seismic doesn’t work.

There are many developments with in-well fibre optic monitoring. Another method is time lapse geochemistry – taking chemical samples and analysing them. This can tell you something about how fluids or flowing around the subsurface, or your “connectivity”, he said.

“All of these solutions are deployed around the Shell group. And we are proactively pushing these out into more and more, even more remote places.”

“It makes sense to combine time lapse geodesy with microseismic or 4D seismic.”

Permanent reservoir monitoring

“One of the more advanced ways is to think not in terms of some individual surveys but to go to permanent reservoir monitoring,” he said.

“To install fibre optic lines or geophones on the seafloor, on land, and conti-
nously visualise and monitor what is happening.”

“These kinds of permanent systems make it possible to get repeatable and measurable 4D signals, being able to regularly repeat it and to make that very efficient.

Fibre optics on the seafloor can also measure seafloor geodesy, small changes in the shape of the seafloor due to oil and gas production beneath it.

“You can have a continuous and optimal measurement of your whole field and the overburden,” he said.

Slow take-up

“But one of the questions I always have, if [permanent reservoir monitoring] is the best thing in terms of surveillance, why is it not happening in the world?” he asked.

“Very few fields have these kinds of systems. We can count on one hand the number of worldwide installations.”

“One reason is the high upfront cost. But after that the opex [operating expenditure] is relatively low. So if you know you're going to do this a lot it would make sense to make this investment.”

“The challenge I want to give to you: why is the uptake so limited and how can we change that?” he said.

One possible reason for slow take-up is that the data from reservoir monitoring never makes it beyond the geophysics domain, when other departments in the company, particularly drilling, could do a lot more with it, once the field is in production.

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**BP’s Field of the Future – moving to phase 3**

BP’s Field of the Future project is now moving to its third phase, which is getting everything implemented and integrated, says Steve Roberts, who leads the program.

BP’s Field of the Future project is now moving into its third phase, getting all of the solutions implemented and integrated across the entire company, said Steve Roberts, VP of Field of the Future at BP, speaking at the Integrated Operations conference in Trondheim on September 25-26.

BP considers that the Field of the Future program has achieved additional production of 75,000 barrels per day of oil through the systems implemented so far, with a longer term target of 100,000 bopd.

The technology has been implemented on 80 per cent of what BP considered to be its highest value wells. “We’ve still got thousands of wells which we are still yet to impact,” he said.

The company keeps track of the value all of the projects have generated. “We track the value fairly rigorously,” he said. “It is important if you have any program to track the value that you are delivering. It helps with your credibility. It helps when you see that the value is showing up.”

The systems deliver value in four ways. Managing operational risk, improving plant uptime, helping optimising production and allow more efficient workflows, which means that more can be done with less people.

In BP’s Gulf of Mexico Thunderhorse fields, the company achieved an extra 10,000 barrels of oil per day extra production, through better management of the operating limits.

The production rate was being constrained by concerns about high fluid flowrates damaging subsea equipment through vibration.

But the Field of the Future methods were used to monitor the subsea equipment much more carefully. This meant that fluid flow could be taken to 97.5 per cent of the maximum permissible flow, rather than 90 per cent, as it was before.

“That actually benefited around 10,000 bopd of extra production just in that one field,” he said. “That’s an example where real time information monitoring information allows you to know exactly where you are in relation to your operating limits.”

Field of the Future technologies were...
used to help with gas lift optimisation in a North Sea field. “We had a very unstable system. But through the use of integration between facilities, well data, physical models, we were able to understand the instabilities of the system, optimise that, and starting to actually reduce the variability,” he said.

“We could move to a new level of performance that was not actually conceivable before. That was adding around 3,000 bopd to the production there.”

Starting in 2000
BP’s Field of the Future program started in the year 2000 “in a remote hotel in Scotland,” he said. “Several of us got together to start thinking about the concept.”

“The first phase was just to prove that we could deliver some value through the digital oilfield concept. We started with a centralised co-ordination effort focussed on a couple of assets, to show that we could create some value through the use of digital information in real time.”

In 2005, the second phase was started, now under the name Field of the Future. “That’s now been running for 7-8 years,” he said. “The initial goal of that program was to show that we can deliver value at scale.”

A range of different solutions were developed and implemented.

Working with vendors
BP has developed about 20 per cent of the Field of the Future technology in-house, 15 solutions altogether. “The 20 per cent our program focuses on are things that you can’t buy at any one time and need to develop internally,” he said.

The other 80 per cent is freely available. “There’s a lot of collaboration with suppliers,” he said. “The other factor we see is we develop something [in-house] which we can’t buy today, then in 3 or 4 years time you realise that the market has caught up and you can buy that.”

“We have this conveyor belt concept where we initially develop something you can’t find anywhere else, we deploy it, we mature it, then we work with a supplier and say you take that piece over, we’re going to go and work on something else, we’ll work with them to deploy and support it at scale. So I see it as a bit of a conveyor belt process.”

Making it robust
“The first things that we developed were early prototypes. But you have to produce those to make them more robust, to deploy at scale,” he said. “You have to have solutions that you can deploy into a fairly variable landscape, and they’ve got to work.

“You’ve got to think about the workflow you’re trying to impact. You’ve got to provide some training to encourage users to change the way they work as you adopt the solution.

“You’ve got to put support mechanisms in place. There’s no point in deploying technology if it’s not supported, particularly if you’re going to learn to rely on that technology,” he said. “We’re realising that the support effort is considerable and you need to make sure that’s maintained.”

“Our program has had to work hard on all these elements. It’s by no mean perfect. We’re learning lessons all the time, particularly as some of our solutions are on versions two or three.”

“A lot of these solutions are integrating lots of different pieces of information together. So there’s that sense of integration that’s going on.”

Components
BP divides the technology into 5 components: measurement, communications, analytics, interaction and integration.

Measurement is measuring the key operating parameters digitally; communications is moving the data to where it needs to go; analytics is manipulating the data; interaction is enabling people to work with the information; and integration is getting it all together.

Once you have installed the technology, you need to be able to use it to control field operations.

“It is all well and good having information telling you should do xyz, but you need to have the ability to intervene in your field to make a difference.”

“You need to think about the process that you’re trying to impact, and you need to have good mechanisms in place to sustain and embed that process, sustain and embed that technology, make sure it is supported for the long term.”

Learning from other industries
Mr Roberts is interested in the automotive, aerospace, nuclear, medical industries, to see if the oil and gas industry can learn anything from them.

“They all have lessons to teach us and I think they’re probably all a little bit further on the journey than we are,” he said.

For example, the automotive industry has a lot to teach the oil and gas industry in how to manage information and encourage people to use it, he said.

“I remember the first car I bought second hand, I proudly showed my dad, it had automatic choke. My dad said, when he had his car he had to crank his engine to start it, or pull the choke and adjust it.”

“5-6 years ago I had a car which was much more sophisticated, it had an engine management system. I was buying gadgets that I was putting on my windscreen. I had 3 or 4 of these gadgets. They were crowding my windscreen, a navigation system stuck on there, a speed camera stuck on there, a temperature gauge stuck on there. My windscreen was looking quite cluttered.”

Mr Roberts now has a car with a dashboard the same size as the one he had 30 years ago, but which provides an enormous amount of information, but presented in a way that it is not overwhelming, he said.

“I sit in there, start the engine, it tells me the condition of my equipment; it tells me how long before I need to change my brake pads, my oil. It is all condition monitoring based. If there’s anything wrong with the car it will tell me, if not it won’t bother me.”

“It tells me the outside temperature, it warns if its icy conditions, it tells me all sorts of things.

But the space on the dashboard hasn’t actually increased.”

“When I go around our integrated operating centres in BP, people say, ‘Steve don’t give me another screen, I’ve already got 30 to look at, give me a more integrated view of the world.’”

“That is the journey we are now on [at BP], how do we take the information that we are gathering from these sensors, in our integrated centres, how do we condense that into more digestible forms.”

With cars, “It has been a 30 year journey to go from the first steps of automation to today’s more integrated vehicle,” he said.

Perhaps it will also take the oil and gas industry 30 years.

“We are over 10 years into the digital oilfield in our industry, I think there’s at least another 10, 15, 20 years to go before we get into the really integrated world.”

In the aviation industry, there would be fuel efficiencies if planes could fly across the Atlantic in formation, like birds, to reduce air resistance. But this would take a lot of co-ordination in the industry. “Today airlines fly individually in a non co-operative way,” he said.

“That sort of vision requires a lot of collaboration from competing companies. That’s an interesting challenge for us to think about.”

In the medical industry, IBM has been talking about going from monitoring and reacting to the human body to being able to predict what is going to happen. This will
involve collaboration between different companies in the medical industry.

**Trusting technology**

Encouraging staff to adopt and trust the technology is a separate challenge to developing the systems, he said.

Mr Roberts told a story about his mother, who has a car with a tyre pressure monitoring system.

“She was driving along one day and the alarm went off, she called me, she says, ‘does it mean there’s something wrong with my tyres?’ I said, ‘You’ve probably got something wrong with your tyre,’” Mr Roberts said.

“But now every time I go round she wants me to check her tyres. I say, ‘mum, you now know you’ve got a system which is doing that for you all the time. You know it works because it sent the alarm.’”

“You just need to rely it and trust it.”

“But she can’t quite get there. So every time I go around she wants me to manually check them.

Similarly, in oil and gas industry, “We have the technology, we can provide the integrated systems, but we need to be trained to learn and rely on them and actually trust them. The industry has to go through that phase where it builds a track record of seeing if these systems can actually be reliable.”

“We need to build a much bigger track record before regulatory bodies will allow us to use them as part of our safety critical systems,” he said. “I think that track record is building, and building very rapidly.”

“I think that’s where the young professionals come in. The next generation that’s coming to this industry actually expects this sort technology. They’ve grown up with it and expect that it can be reliable. The next generation is key for adoption in the industry. Some of us die-hards are a bit fixed in their ways.”

“I do see part of the adoption phase is the next generation coming in the industry and helps us understand how we can use these systems to great effect.”

**Regional variation**

“In BP, as far as we can, we try and standardise our work processes across our footprint [around the world],” he said.

“I’ve been moved around the world [while working at BP] and one of my frustrations was that I was doing a similar job [in different places], but every time I go to a different locations I have to use a different system to do the same job.”

“In BP for 10-15 years we’ve been trying to standardise how we do our work around the world, so as we move people around, people already know the system and how it works.”

“We’re seeing different adoption rates in different regions,” he said. “There’s a lot of variability out in our industry. There’s cultural variability, there’s data variability. Some areas we’ve seen the adoption curve very rapid [steep]. In other areas it’s taken a while.”

“We have different resource types, different geographies we have ice at one extreme and tropics at the other extreme. So one size doesn’t fit all. We try and standardise and then we will modify where we need to.”

“In Trinidad we’ve had a team working for 18 months on a management process that we’re trying to embed. To really get that process fully embedded in quite a complex production system is taken about 18 months.”

“I think one of our success factors is to actually have people on hand that can show how you can do things in a different way,” he said.

**Management information**

“At BP we’re seeing an increasing appetite for roll-up of information, management dashboards, summarising, and condition monitoring, integrated planning,” he said. “I’m seeing an increasing appetite from management for more of this information.”

“What amount of information is required at each management level for management to take decisions that they need to take.”

“One of the things we’re working on is architecting the different layers of information required at each management level and making sure that we can support that.”

“There’s a lot of effort around integrated planning in BP both locally and globally, making sure our rig schedules are integrated with or local requirements.”

**Management of change**

“If you just focus on technology then I think you’re destined for failure,” he said. “I have seen several projects at BP where you just throw technology over the wall and expect it to be taken up and adopted. Management of change is absolutely key.”

“You’ve got to start in our program, right at the beginning of any project, what is the business project that you are trying to enhance, and how can technology be applied to that.”

Then followed up with, what is the management of change to adopt that technology.”

“The industry doesn’t get a lot of change. In the oil and gas industry “our basic techniques don’t change very much, we’re still drilling percussively small holes in the ground to extract oil and gas,” he said. “And yet the digital technology we’re trying to apply changes every 6-18 months.”

BP now tries to “future proof” everything, make sure everything that it installs will work with whatever happens next.

“That’s a huge challenge,” he said. “If you look back 10 years the devices we used then are very different from the devices we use now. Trying to predict what they look like in 10 more years is almost impossible.”
Integrated operations at Ekofisk

ConocoPhillips Ekofisk field, offshore Norway, is one of the world’s leading fields with integrated operations. Ole Klingsheim explains how it works.

“We call it integrated operations, because that’s really what we try to do” - Ole Klingsheim, Integrated Operations Development Manager with ConocoPhillips


Mr Klingsheim has served as ConocoPhillips’ Integrated Operations Development Manager within its “Major Capital Projects and Operations” division since 2008, responsible for the continuous development and implementation of ConocoPhillips’ operating model.

“Today after more than 40 years of operation and more than 2.5 billion barrels of oil being produced, it is still one of the largest oilfields around.

“We think we have a good story to tell. There’s a lot of knowledge we can share, a lot of experience we like to transfer. We are proud to talk about our successes.”

“Actually we do talk quite openly about our mistakes too. But I’m not going to do that in front of 300 people at a time, we normally do that in smaller groups!”

“Ekofisk has it all – exploration, drilling, production, late life, plugging and abandonment decommissioning, and a lot of new developments.

In short we have all the activities from cradle to grave.”

“Ekofisk has really been good to us all, owners, partners, the Norway society, contractors, everybody. The total value generated from Ekofisk over these years is more than 1,800 bn Norwegian Krona ($314bn). That’s a lot of money.”

“It is 60 per cent of the Norwegian pension fund alone from one part of the operation.”

The Ekofisk field includes 29 platforms altogether, with 1,000km of pipeline connecting them.

There are 6 helicopters transporting 75,000 passengers to Ekofisk every year. There are 1300 people offshore every day, and 5,000 people call Ekofisk their workplace, he said.

Search and rescue services for the Southern sectors of the North Sea are also provided from Ekofisk, on behalf of Norwegian authorities.

“Ekofisk is in many ways a unique field. It is chalk, it is subsiding, it is the first and the biggest on the Norwegian continental shelf, the first discovery,” he said.

“In terms of remaining reserves, it is still one of the longest horizons left out there, and it still attracts some of the biggest investments on the shelf.”

40 years past and future

The field celebrated 40 years of production in 2011, and in the same day, a plan was approved for redevelopment of Ekofisk and Eldfisk fields, at a cost of NOK 83bn (USD 14.5bn).

There will be 80,000 tons more steel installed in the Southern part of the North Sea in the next 2-3 years, and there are currently construction projects going on in 10 different countries, he said.

“We have made substantial investments in new platforms, new infrastructure, and these investments has given us the desired results,” he said. “We now enjoy production in the same levels as we had back in the 1980s.”

“We’re going to be around for at least another 40 years. That long term perspective makes us do different things than if we had a short perspective,” he said.

When Ekofisk was first built in 1971, the year 2000 would have seen like sci-fi.

“That was beyond the foreseeable horizon in a way,” he said.

“Now we are there.”

Improving recovery

“Our recovery rate has increased from 17 to 18 per cent back in the 1970s to more than 50 per cent now.” This has meant a doubling of the expected lifetime of the field.

“Every per cent we can squeeze out of this huge field is the equivalent to another new field in other places that would have been developed, so it’s worthwhile continuing squeezing this.”

The increase in recovery “hasn’t just come by itself, it’s been hard work,” he said.

“There’s a lot of new technology, like horizontal drilling, life of field seismic, waterflood and reservoir management. All of this has been in continuous development.”

Integrated operations

The company sees ‘integrated operations’ as its operating model. “The way we look at this is that we also need to re-create our organisation, our mindset, our operation. That’s what we call integrated operations,” he said.

“It’s not always straightforward. What do we mean when we say integrated operations? We all mean different things, slightly different or very different. We have different focus. We all try to accomplish the same but we focus on different things at different times.”

“We call it integrated operations, because that’s really what we try to do, to integrate. Integrate offshore, onshore. Integrate our functions, onshore, we go as hard as we can after the integration.”

There are many interdependencies between different company units involved in Ekofisk. “To understand those and have them transparent to everybody in the organisation is the key and that’s part of the foundation for our integrated planning,” he said.

“Our operating model is not a project,” he said. “It is a continuous improvement journey, it’s a commitment to continuous improvement to develop this operating model. It is hard work, and it’s never going to go away to continue to develop this model.”

“We can do it by doing this is to improve the performance across all of our operations.”

Benefits

“A question we often get is, is this just talk
or is there real tangible benefits?”
“... We have improved our maintenance efficiency by more than 15 per cent.
In our operations that is the equivalent to around 100 people offshore.
That’s a significant number. We can choose to do more with the same people or to do the same with less people. And then have other people adding more value, take up the helicopter seats and bed space offshore, which are our main constraints.”
The production is more stable, and there are fewer unplanned shutdowns, he said.
The supply vessels to the rigs are managed onshore. “We see we move more material offshore than we used to do, but we do it with one less vessel in the fleet. We have eliminated spot charters. All of this shows up very nicely on the bottom line.”
For many years, people in other parts of the world were sceptical about what ConocoPhillips was doing in Norway, saying that “Norwegians have too much money,” Mr Klingsheim said.
“But what we have shown has demonstrated results.”

Risk
Integrated operations can help manage risk. ConocoPhillips has seen the number of times that it has ‘energy out of control’, its terminology for some kind of leakage, decline over recent years.
The background, what drives this, is the additional barriers onshore that we can put in place,” he said. “By having more people, more eyes to see, more complete picture of the situation that we have offshore, the situational awareness is shared. But the foundation for all this is the integrated plan.”
“Hopefully you’ll agree with me that fundamental aspect of HSE excellence is good planning. The more often we do what we plan to do, with the people we plan to do it, at the time we want to do it, the less unwanted things happen.”
“We don’t have to do adhoc planning, we don’t have to change and run in a different direction. The operations stabilises, everybody knows what’s going to happen.
“Preparation, communication, decision making, all of these good things that you see out there. These are the fundamental aspects of HSE, no doubt about it.”
“We think that’s a foundation for our improvement in this part of the operation.”
“In the past we had no other choice, we sent the people offshore, they would do the best judgement, make the decisions. Now we can bring in more expertise, see the complete picture in a totally different way.”
“We collaborate with offshore to make

Organisational capacity
“We really firmly believe it is the organisation’s capacity that is the underlying driver to achieving the results we want,” he said.
“We are heavy in measuring all kinds of parameters. We perform analytics, we visualise performance; we have scorecards, KPIs, the whole shebang.”
“For production and uptime, the direct parameters will be simple indicators to indicate bottom line impact,” he said.
“But it is also interesting to see results that come from sort of less tangible things like the communication, the decision making.
The big thing to us is the accelerated learning. To work in these cross functional, real time, lot of information type arenas, is an accelerated learning environment.”

Continuous improvement
“The foundation for all of this is our institutionalised continuous improvement, that’s the engine, the engine coming in the back to keep us going,” he said.
“We have put it in the organisation; it says continuous improvement on the organisation chart. We have dedicated people working on it.”
“We track the deliverables. It is not acceptable to not deliver bottom line results.”
We base this on lean six sigma, so we have the methods and tools and training. We sustain this by doing this formal training.”
“Change management, in a strong continuous improvement culture, is really what we think drives us. To identify opportunities, to be able to implement opportunities and to be able to harvest the benefit from these opportunities.”
“Also our ambition is to keep growing the company. We move into harsh environments, remote locations, the efficient operation of all of these is still the key enabler for all of this.”
“I think this journey will continue to mature our operating model. I don’t think we have figured it out. It is not what we thought it would be 5-6 years ago, it is different. I think it’s going to be different again going forward. It will continue to mature our understanding.”

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Statoil’s view on IO

Øystein Michelsen, executive vice president, Development and Production Norway, Statoil, is impressed with what integrated operations has achieved for the company.

“Technology has triggered a change in the way we address things,” he said.

“We have written integrated operations into our governing systems processes.”

“It’s no longer a matter of taste or preferences. Integrated operation is how we work. It is now tied so closely to our work processes that we are not able to do a job in a compliant and efficient way without making use of integrated operations.”

“In an organization of our size, quite a big organization, it requires quite a substantial amount of work to get all our employees offshore and onshore to pull in the same direction and work towards the same goal.

“It has been a matter of management, it requires a lot for our leaders, and we have been going through a cultural change to make use of the endless possibilities that a more integrated work pattern gives us.”

“Through our 4 years of history [with integrated operations] we have seen a development where we are going from more or less autonomous [offshore] platforms to a more integrated way of working,” he said.

Expert centres

“One of the major steps towards an integrated future is the establishment of expert centres that can support all installations across the Norwegian Continental Shelf,” he said.

“This requires an operational and accessible offshore-onshore organization that can actively and efficiently support the offshore operations.”

“Gathering the experts of a certain domain area in one centre not only gives us an expert group that can more effectively support the operations, it also has a beneficial effect on the development of the group staff. The centre allows the members of the group to draw synergies and extract learning from all our operations.”

“Instead of having to go offshore every time every time a problem occurs, our experts can now help the operational staff to solve the problem from an onshore location, thereby avoiding time and can save in travelling.”

“Multi-field Operations’ is one of the expert centres that we have established after the merger between Statoil and Hydro five years ago, and it was a milestone related to the creation of the common operating model.”

“With responsibility for heavy rotating equipment, physical metering, telecommunications and safety and automation systems the multi-field operations is an important tool for planning and execution or maintenance that requires absolute dedication and operational competency.”

“Multi-field Operations’ keeps an eye on all the machinery within the field of work across all our platforms and is ready to maintain, support or repair as and when needed.”

“The unit represents the cross-disciplinary mindset that can help create a common understanding of any problem that might surface. It also helps to transfer experience across different assets and to develop best practices and to make them known throughout the organization.”

“So for any of you very interested in this I can recommend a visit in Bergen where we have an operational centre.”

Video and chat

“We have reduced the amount of travel in the company substantially in the last few years, and we are utilizing video conferences whenever possible,” he said.

“We have implemented a chat system and a computer to compute a video conference system. So even the smallest operations can be done facing your colleague whether he/she is in Bergen or in Orga or in Baku.”

“So new collaboration tools provide better access to production data and makes sure that those who are involved in the operations are more hands-on and closer to the operations, even if they are not physically there.”

Telemedicine

“In 2007 we had a pilot on telemedicine. This project was operational on the Norwegian Continental Shelf in 2009.

“With support from hospitals across the coast of Norway, we are able to assist our medical personnel offshore with both medical examination diagnostics and recommendation towards treatment. So live patient data such as Electrocardiography (ECG) may be transferred and thereby aid in the diagnosis of various medical conditions.”

“The direct observation of the patient is also a major improvement for the medical doctor on duty. Through this way of working, we are able to make a better diagnosis helping us to fight the damage or illness earlier and more efficiently.”

“It’s mainly a communication to giving the doctor on call both eyes and sight and better ears.”
“It makes a connection between life and death on few occasions and we actually make use of it.

“A spinoff of this is that the telemedicine setup on all our platforms provides the platforms with high quality camera equipment that can also be used for other purposes, for example for inspection and identification of equipment when that is needed.”

Suppliers
Suppliers need to get involved with integrated operations too.

“A substantial amount of all the work that is carried out on the Statoil operated installation is done by our suppliers. And important changes to our way of working must also be integrated by suppliers if they are to take effect the entire Norwegian Continental Shelf,” he said.

“Major contracts like the maintenance and modification contracts and the installation scaffolding and surface contracts that were established in 2010 have implemented integrated solutions as a part of the structure in the contract.

“That also goes for several drilling contracts that we have on tender over the last years.

“All of these suppliers would typically establish operational centres onshore to secure cooperation and sharing of information with the operational personnel offshore, and try to move as many activities onshore as possible.”

“Working in an integrated manner reduces the number of personnel on board, making space for the activities that are also critical.

“We have great expectations of further integration between Statoil and our suppliers. I have no doubt that this will continue to influence our operations on greater scale also in the years to come. ”

Production optimisation
“One work process we are particularly proud of is the so called production optimization groups,” he said.

“Every morning, and even more often than that if the situation requires more frequent meetings, our platform management and petroleum technology experts meet up to look at the current production from the platform and how to optimize it.

“Access to data is crucial to all our operations, and because the real time transfer of data, both parties have access to all the information they need to determine how we make most of the wells.”

“In fact this means that we can actually control the wells from our office locations onshore, also means that we all can see the same picture, and that we can make use of experts at several locations to ensure optimal results.”

IO – getting it implemented
A discussion at the Trondheim Integrated Operations conference covered different configurations of IO, how much to standardise processes, how best to integrate suppliers, the difference between standardisation and governance

“If I buy a car I know the basic principles that it has to do. With some of our technologies, it works, but it doesn’t work in the environment we want to roll it out to. A technology needs to work in the Shell architecture, not just IT architecture.”

On the flip side, sometimes people try too hard to make a solution perfect before implementing it.

“Are we trying to aim for the 100 per cent solution, something which is awfully difficult for someone to adapt to, or going 0 to 10 to 60 per cent, which is already a massive change in performance improvement?” Shell’s Mr de Best asked.

“Sometimes we are going too often for the 100 per cent solution and can’t get it embedded in the organisation.”

The right configuration
The key to a successful integrated operations implementation is “to understand the configurations of technology, process, people and governance, really to address it,” said Vidar Hepsø, Principal researcher and Project Manager at Statoil ASA.

“All IO work is really about creating sustainable configurations. That is one of the major lessons.”

“There are people who don’t understand why you should distinguish between process and governance. But you can have the same work process and change your governance model.”

You have to work out how much standardisation you want. You want some kind of standards for the company which are managed centrally, but if the standards are too tight, you won’t have room to deal with regional variations, he said.

“You have a trade-off between making things standardised and local autonomy.”

There is a difference between the maturity of the technology, and the maturity of the organisation which is about to take in the technology, he said.

“In the past we have very good examples of where we thought we had a mature technology but we didn’t have a mature organisation that was able to take in the new technology.”

Standardisation and flexibility
BP sees standardisation as a way to achieve more flexibility, Mr Roberts said.

Similar to the way that you can build many different things with Lego blocks, because they have a standard way of connecting with each other.

“As a large company with over 100 assets worldwide, in a model where we have to deploy things all the time locally, there’s a
lot of complexity to deal with,” he said. “If we standardise, we can plug and play more.”

“We have an entire PC infrastructure on one platform,” said Shell’s Mr de Best. “Anywhere I go around the world I can find a printer in the office in 5 minutes. From a security point of view it is all globally managed.”

“But if you go to the technical part of operation units, there are all kinds of restrictions there.” For example, some countries have restrictions on whether data can leave the country.

Change easier in other industries
BP’s Steve Roberts noted that change can be easier in other industries than it is in oil and gas, because they don’t have to deal with lots of older equipment all the time.

“In other industries they are always building new products, a new car, a new aircraft, they can install from scratch,” he said. In oil and gas we have a lot of legacy platforms and infrastructure to retrofit.”

Rigid standard processes?
“About 10 years ago, Shell embarked on a program to standardise global processes,” Shell’s Mr de Best said. “The basic oil field workflows, processes, which were standardised and had to be rolled out.”

“But by bullheading workflows into a proud operated community, you get an enormous amount of resistance.”

So is it really helpful to try to force a standardised workflow, when the way people work is all fairly similar around the world anyway?

“At the end of the day, a BP well is the same as a Shell well if you want to operate it. A well in Brunei is the same as a well in the Netherlands. If you take the team and guide them through it you end up with same result,” Mr de Best said.

Making data available
“People in the next generation at BP want data to be [readily available] in their environment,” Mr Roberts said.

“They don’t want to carry it around, they want to walk into a collaborative environment, the data will [already] be there, and they’ll work together with their colleagues to do some good things.”

“I have a regular lunch with the ‘next generation at BP to explore their vision of the future,” Mr Roberts said.

“With cloud computing, cloud storage, we’ll see a trend where data is available in your environment, and we’ll be able to work much more collaboratively.”

“I think the way the world is heading, it will just be naturally available.”

Trust
It isn’t necessary true that people have to meet each other face to face to have a trust – sometimes the trust can be developed from knowing that there is someone available you can depend on, said Shell’s Mr de Best.

“We have in Shell a “following the sun” support principle, which is nothing more than 24-7 support around the world, in Houston (USA), Bangalore (India), Rijsijwijk (Netherlands), for deep-water drilling,” Mr de Best said.

“Those centres are critical in making sure we have continuous support.”

“People trust each other, [although] they haven’t seen enough other face to face. There is a mechanism there which has driven those centres towards success.”

Suppliers
There were several comments that integration between suppliers and oil companies was not moving so fast as integration within the company itself.

Sometimes oil companies just specify what they want suppliers to do, and think that is all they need to do.

“I don’t think change management by specifications or requirements is sufficient,” said Jon Lippe, Operational manager of the Center for Integrated Operations at NTNU.

“How do we make more leaps in the relationship between suppliers and the oil companies?”

BP’s Mr Roberts said that there are “more integrated” digital oilfield offerings coming onto the market, which make it possible to deal with a reduced number of suppliers.

“We’re seeing offers where a company can run its own proprietary software onto a commercial platform,” he said. “I think those offers will really help move forward.”

Ole Klingsheim asked why the oil and gas industry can’t manage implementation of new technology the same way that Apple does it, that is to say, make the technology very compelling and then you don’t need to ‘manage’ change at all.

“When Steve Jobs turned up on the podium, nobody knew they needed an iPad until just after he presented it. Then we all knew, I need one of those. By desire, functionality, that change happened.”

“Are we not making clever enough solutions? You vendors, why don’t you give us solutions that will propel itself into this?” he asked. “I think they are good at making stuff people want.”

Sometimes suppliers are constrained by not being able to access data. “There was a company in Norway that thought there was a market for new services in condition monitoring, they invested, but they were not able to pull it off, because they were not able to get the data they needed,” said Kaare J Finbak of Kongsberg Oil and Gas.

Unified communication
“The biggest change that actually has happened in Statoil in the last 2-3 years is the introduction and usage of unified communication,” said Statoil’s Vidar Hepsø.

“That has changed the way we do business in many ways. You can have desktop video, you can have chat, you can have much more type of collaboration. You don’t have to go to a meeting room, you can phone up any conference room in Statoil.”

“Just having this awareness that if people are available or not, you can see that on the screen. Even people in their 60s start using chat.”

“That actually happened within 1 or 2 years, it happened very fast.”

“It had consequences for how we use the open spaces.

Moving control onshore
Is it desirable or achievable to move decision making and control onshore?

“We have a lot of uncertainty in our industry, there’s a lot of risk, so need to be careful moving work from offshore to onshore environment,” Mr Roberts said. “It takes time.”

“The regulatory authorities have to be satisfied, they are looking for a track record. In certain parts of the world you have resistance from unions; they see it as eroding jobs.”

“You have to show you can do the work onshore to the same quality if not higher quality, and get a track record so you get the permissions.”

Mr Roberts also noted that the complexity of offshore operations is increasing all the time, with more stringent environmental requirements and more production streams with imperatives which need to be removed, such as hydrogen sulphide. So at the same time work is being taken onshore, the workload offshore is increasing.

“There are numerous amounts of examples of platforms offshore which are operated without anybody on board,” Shell’s Mr de Best said.

“As an example, our gas platforms in Qatar are normally unmanned. Gas production platforms in Holland are 2 weeks unmanned. So the developments are moving towards normally unmanned operations.”
Learning from healthcare

Professor Samer Faraj, Canada Research Chair in Technology, Management and Healthcare at the Desautels Faculty of Management at McGill University, Montreal, talked about his studies of staff working at hospitals dealing with emergencies, and how the oil and gas industry might be able to learn from that.

Professor Faraj did a study of the R Adams Cowley Shock Trauma Center at the University of Maryland, Baltimore, near Washington DC, which claims to be the only integrated trauma hospital in the US.

The centre employs 250 specialists, and is proud of a survival rate of 97 per cent. It deals with a wide variety of problems.

It has a focus on treating people within an hour of having a shock, because if the body is not treated within an hour after a shock, the body goes into a deeper shock, he said. “Timing is crucial. We have a very narrow window for treatment.”

His conclusion, which is maybe something the oil and gas industry can learn from, was that the best way to get a good outcome was simply “to get the best people, put them in a team, give them the best resources, you have good outcome,” he said.

People are organised into ‘communities of practise’, such as surgery.

But there are no teams as such, people don’t know who they will be working with from one day to the next.

“I don’t feel they were operating as a team,” he said. “Organising as their own community of practise works better.”

There’s a manual with rough protocols which should be followed, but there are also many cases when people don’t have time to follow all the procedures in the protocol, he said.

“When individuals with different expertise have to collaborate, the process cannot be specified ahead of time.”

The expertise includes both “know-how” and “know-what”, he said.

There are two possible structures to any organisation, the unambiguous chain of command (military style) or the delegated decision matrix, where people can make their own decisions. “We’ve never settled on which one is better, most organisations have a bit of both,” he said.

A collaboration on the fly is known as ‘dialogic’ collaboration. Perhaps ‘dialogic collaboration’ would be a good concept for the oil and gas industry, he said.

Can we be more flexible?

Do we design facilities assuming that we know more than we do, asks Andrew Gibson

Andrew Gibson, research manager at MARINTEK, A research company in the SINTEF Group with does research and development in marine technology, said that we would have a better results if we accept our lack of knowledge about what will happen in future, and designing more flexible facilities, so they are better able to cope with what the future might throw at us.

Are we sure “nothing is going to change? Or should we be thinking about slightly more flexible field developments?” he asked.

There are plenty of examples in history, where the finest engineers were sure they knew exactly what to do, and then the passage of time proved them wrong, he said.

People had carefully thought out construction and drilling plans, and suddenly had to change them when drilling went differently to how it was expected.

Experts were surprised in Oman in 2000, when the country suddenly found oil production had peaked.

Experts were surprised in the year 2000, when a car company increased use of electronic systems in cars. “They knew exactly what they had to do [but went on to have] immense problems with reliability for the next 3,4,5 years.”

Sharing knowledge about facilities operations

www.cppf.no

Plans are underway in Norway for a centre for sharing knowledge about facility operation between oil and gas industry and research and development community.

Oil and gas companies are invited to join by contributing NOK 5m (USD 877k) annually over a 5 year period.

There are plans for 4 research programs:

- Managing the risk of major accidents, including improving risk assessment, development key performance indicators, monitoring safety barriers, and creating a culture better able to handle unexpected events
- Improving the (human) organisation under complex conditions, including organisational resilience, organisation learning, enhancing working environments,
- Strategies for life extension and re-assessment, including assessment processes, assessing structural integrity, procedures for repair, data collection, condition monitoring, criticality analysis
- Supporting safe facility and marine operation, including modernising control centres for operation and information management, monitoring the ship/aircraft/submarine operations interface, and simulating complex marine operations before doing them.

The facility will also educate PhD and MSc students.
Are e-commerce standards hard to implement in the oil and gas industry – because people are trying to make them too perfect? Our report from the PIDX Autumn Europe meeting in London on October 17

One big question for PIDX is, “why is it so hard?” said Christina De Luca, chief procurement officer for refining and marketing at BP and a board member of PIDX.

One big question for PIDX is, “why is it so hard?” said Christina De Luca, chief procurement officer for refining and marketing at BP and a board member of PIDX, the oil and gas industry forum for developing processes and standards for electronic business.

She was speaking at the PIDX Europe Autumn meeting, in London on October 17th, 2012.

“Our goal is to develop, publish and maintain the global standard. We are far away from that,” she said.

“Even with 25 per cent increase in utilisation of standards, I don’t see our current pace achieving the goal of being the global standard setter.”

“How long does it take to develop a global standard? Do we have 6 months - 18 months - to develop a global standard?

“What are we missing? Why aren’t we getting more people to sign onto the vision of PIDX? What are other people missing that we see?”

Perhaps one problem is that people are aiming to get everything too perfect, and end up not getting anything done at all, she said.

“PIDX has gone on to publish and maintain global standards. We’re doing it with volunteers. Are we searching for the 100 per cent solution?”

“People are a key enabler of what we’re trying to achieve and critical to achieving our goal as PIDX,” she said.

“Every single person wants to master data. But everybody has their own master materials process. The issue is developing a common one.”

Perhaps “people maybe spend too much time developing and maintaining the standards, and not enough time explaining why the standards can help reduce work and reduce errors for people using them,” she said.

It is much easier if people can see a personal advantage to using the standard. “If we can’t tie it to a carrot all we have is a stick, I don’t think sticks work very well and it’s very exhausting to maintain,” she said.

At BP

Like much of the rest of the industry, BP is going through a phase of integration and standardisation at the moment, she said.

BP has grown through a number of acquisitions, and has “probably the world’s largest collection of ERP systems, standards and ways of working,” she said.

“Downstream, we have 150 different charts of accounts.”

“We also have a culture of individualism, the ‘business unit model.’ Business units could choose ERP systems, what to outsource.”

All of this makes procurement inefficient, she said.

Meanwhile the “macro” environment which BP works in, has become much more complex.

It used to be “steady growth and predictable inflation, dominated by the US and Europe,” she said.

Now it is “a world of increasing volatility, increasing government intervention. Societies and governments are unwilling to accept risks.

Demand patterns are changing. Consumers are looking for less environmentally impactful products. Customers are demanding increased value.”

“We’re seeing margins shrinking and shareholders demanding quarterly improvements.”

Ms de Luca said she recently suggested that BP abandoned its goal of trying to set a single master database for the company, because “the money we are spending trying to master data is not delivering the value that we want,” she said.

“I expected our failure to jump up and down with joy, because the ‘centre’ was no longer demanding (a standard).”

“But they didn’t,” she said. “Everyone in our facilities voted (for) a global standard.”

“But they still think they all have their own global standards.”

Different purchasing systems

In one facility, BP tried to implement an Amazon-like purchasing system, which meant you could search for items using free text rather than codes.

“I’ve never remembered any SAP codes. I don’t find it intuitive,” she said.

But “98 per cent of employees pretty much refused to use the system,” she said.

To understand why, you need to understand that people find it much easier to phone a supplier directly. “Calling a supplier is a whole lot easier than 10 clicks,” she said.

[people say], “There are maintenance people I can call and get a part I need,” she said.

In another facility where BP tried to install an Amazon-like purchasing system, staff rejected it, because actually they were more comfortable with their ERP system. There were only a small number of codes they needed to enter for different products, and they knew them all.

“They didn’t understand why they had to click through 10 screens. That to them was a complete waste of time,” she said.

“In installing what we thought was simplified and user friendly, we created work for them.”

“Is it any surprise that they rejected the system? We didn't think about a human being, we didn't think about what was important to them.”

The PIDX meeting at the Royal Automobile Club on London’s Pall Mall
Getting suppliers on-board

Angie Marquardt, Western Hemisphere procurement manager for BP’s refinery and marketing business organisations, has recently been involved in a project to improve ‘supplier enablement’ at BP, or in other words, getting suppliers more integrated with BP’s procurement systems.

"Supplier enablement, like a lot of standards, isn't actually defined," said Angie Marquardt, Western Hemisphere procurement manager for BP’s refinery and marketing business organisations, speaking at the PIDX Autumn Europe meeting in London on October 17.

Everybody has a different view about what supplier enablement is.

“Supplier enablement has been quite a bit of a journey for BP,” she said.

“We built some things and nobody came.”

“If everybody is coming at it from a different place, it gets a bit confusing. If we can’t define supplier enablement, how can we find (technology) suppliers to deliver it?”

“We decided what we care about is cataloguing data management,” she said, having supplier catalogues readily available in BP’s procurement systems.

“So we built some things and nobody came.”

“Also standard document exchange – what are the messaging protocols, what are the file standards. Purchase to pay, requisitioning, and invoice management.”

“The data we were getting wasn’t standardised,” she said.

The initial idea was that BP would subsidise the costs of getting suppliers connected to BP’s procurement system, said Art Skinner, systems and data manager for BP refinery and marketing’s US fuels value chain management organisation. “That’s how we got 850 suppliers on day one.”

“Then we changed the model to one where suppliers pay a fee.”

Looking for a standard definition of supplier enablement: Angie Marquardt, Western Hemisphere procurement manager for BP’s refinery and marketing business organisations.

Developing the standards

Suresh Rajami, commercial IT and customer relationship management (CRM) leader with GE Oil and Gas drilling, and chair of PIDX’s standards and guidelines committees, talked about the work at PIDX to continue to develop the standards.

“One problem is that we have so many standards, and we don’t have an idea what is being used,” he said.

“My understanding is [that the commonly used standards are] invoice, invoice response, field ticket, field ticket response.”

PIDX has a complex system for defining how standards get approved by members.

It is working on an enhanced price sheet system, which should lead to faster approval of invoices and less manual processing, he said.

Some PIDX standards are 10 years old and some of them need updating.

“We want to support expansion into international markets and the use of mobile technologies,” he said.

Standardising catalogues

As well as standardising the communications and documentation between buyer and seller, there is a growing interest in developing standards for cataloguing systems – how suppliers present their lists of products to buyers, with pricing, and buyers make their choices, within the procurement systems.

JCatalog, a company based in Dortmund, Germany (Www.jcatalog.de) works with a number of oil companies and suppliers in the oil and gas industry to help improve their catalogues. It has worked with Schlumberger, BP, Halliburton and Shell.

“We’re interested in what we can do in PIDX around catalogue standards,” said Kelly Babbitt, Head of Marketing and Business Development with JCatalog.

“Just because you have a standard doesn’t mean you implement it the same way as the guy next door. Having a clear definition of process and a reference definition of what the expectation is to do with the stan-

Developing the standards further: Suresh Rajami, commercial IT and customer relationship management (CRM) leader with GE Oil and Gas drilling, and chair of PIDX’s standards and guidelines committees.
If we could standardise catalogues there would be benefits for everybody, said Kelly Babbitt, Head of Marketing and Business Development with JCatalog

standard is very critical,” he said. “Otherwise you get 6 versions and they’re not interoperable.”

“It is important to write down the business benefits and impacts of the standard.”

Many suppliers provide catalogues in different formats, and have different information which needs to be provided in order for orders to be made, in a range of different forms.

“Lots of products and services have forms attached to them, they are all bespoke,” he said.

If different companies would agree to the same cataloguing system, it would make it much easier to implement systems for buyers to select products from the suppliers’ catalogues, he said. “That lifts the water for all boats.”

Another complex area is how prices go up and down, for example depending on fuel costs or metal prices.

In Siemens, for buying and selling within the company, 52 different business units agreed on a common index for how surcharges would be added to prices if metal prices rose higher than expected.

It would be a step forward if oil and gas companies could agree on how the surcharge would be calculated, even if they didn’t agree on the specific index (how much surcharge would be added if the commodity price increased by a certain amount).

“We think, if we can agree on standards and data for catalogues - we can help build these business drivers,” he said.

It could also be possible to incorporate other standard systems into the PIDX standard, such as hazardous materials standards and the he United Nations Standard Products and Services Code (UNSPSC).

Supplier KPIs

Mike Washington, integrated performance lead at ConocoPhillips and vice chair of the PIDX supplier KPI standard work group, talked about PIDX’s work to develop standard for key performance indicators, which the oil and gas industry can use to measure the performance of their suppliers.

Supplier KPIs have already got very complicated. “There's KPI definition chaos,” he said. “Often there's not a clear understanding about what KPIs should be measured. There's scorecard overload, many different formats, many different styles.”

There is also a lack of standardisation in the terminology which is used, he said.

The scorecards and KPIs are used in drilling, operations, chemicals and aviation, construction among other areas,

Operators involved in the supplier KPI committee include BP, Chevron, ConocoPhillips, EL Paso, Green Energy, Kinder Morgan, Noble Energy, Nexen, Petroleum Development Oman, RWE, Shell, Statoil and Wintershall. There are also “expressions of interest” from Cairn Energy, Murphy Oil, Origin Energy, Penn West Exploration, Tullow Oil.

Suppliers involved are Aker Solutions, Amec, Baker Hughes, Cameron, GE Oil & Gas, Halliburton, NCH Corporation, Quality Distribution Systems, Schlumberger, Siemens and Weatherford.

“It is very challenging to get operators and suppliers to agree on performance areas,” he said.

The basic framework for performance areas is health, safety and environment (HSE); quality; delivery; cost; behaviour.

Then there are company specific KPIs, covering the delivery of services and materials, whether they were on-time, how flexible the supplier was.

Participants are asked to submit their own KPIs to PIDX to include in the PIDX supplier KPI data dictionary.

Most HSE standards are well established in the industry (lost time injuries and so on). “Many of the KPIs utilised by us are really very similar,” he said.

Many people in the industry used to keep their key performance indicators as a company secret, but “that mindset is slowly changing,” he said.

“KPIs are a tool with which we can better manage our business, so we all understand what our goals and metrics are.”

The effort is aiming to standardise which KPIs are being measured, but not to share the performance data itself.

Aiming to help resolve supplier KPI definition chaos: Mike Washington, integrated performance lead at ConocoPhillips
Founded in 2000, OFS Portal is an organization which consists of diverse supplier members who are committed to promoting eCommerce and reducing cost. We have a non-profit objective to ensure we promote the best approaches for the industry. In addition to advocating strong protection for the security and confidentiality of electronic data, OFS Portal has gained the trust and confidence of the entire upstream oil and gas industry. We do this through our proactive advocacy approach toward best practices to reduce costs and complexity while increasing the speed of adoption.

Our Community:

- Anadarko Petroleum
- Anderson Energy
- Apache Corporation
- Approach Resources
- ARC Resources
- Atium E & P
- BAPCO
- BHP Billiton
- Bill Barnett
- Black Hills Exploration
- Bonavista Petroleum
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- Canadian Natural Resources
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- Chesapeake Energy
- Chevron
- Chief Oil and Gas
- COG Operating
- Common Resources
- Compton Petroleum
- ConocoPhillips
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- DCP Midstream
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Our Members...
Geofacets - search geological papers by map

Geofacets from Elsevier, an online tool for searching academic geological content, now includes papers from more professional societies

Geofacets, the online tool from Elsevier for searching geological academic maps and papers, is making content from SEPM (Society for Sedimentary Geology) and the Society of Economic Geologists (SEG) available in the system, as well as existing content from Elsevier itself and the Geological Society of London (GSL). The SEPM maps and papers are available immediately, with SEG set to follow in the new year.

Geofacets was launched in 2010 to help oil and gas companies make better use of the available academic geological information that has been published. Now it is used by approximately 30 companies.

Elsevier currently publishes close to a third of all geological academic papers, in journals such as Sedimentary Geology, Marine and Petroleum Geology and the Journal of Structural Geology. These titles, along with many others, are all covered by Geofacets.

“We felt academic information was under-used,” says Friso Veenstra, Director of Market Development at Elsevier.

You can search for maps in specific parts of the world, or which mention specific geological features, or by the author of the paper.

Once you’ve found an interesting map, you can read the content in the paper which the map was published in.

The primary target audience is people who work in geoscience looking for petroleum, or “soft rock geoscientists”. It can also be used by geologists looking for minerals and metals.

Saving time

The purpose of Geofacets is to save company geologists time while providing a comprehensive overview of the relevant academic literature. When considering exploring in a certain part of the world, it can make the task of finding all the relevant geological papers and maps much easier.

The tool is designed for companies evaluating new exploration possibilities, who want to see what has already been done there.

“It’s a way of getting your head around a certain area,” Mr Veenstra says.

“People tend to use it frequently and intently as they go to a new area.”

You start by searching for a map, then you can read the paper explaining how the map was drawn and the geology interpreted. “So the maps provide an entry point into finding more information,” he says.

People don’t want to spend time looking for the right maps. “You want to start interpreting, analysing and drawing conclusions,” Mr Veenstra said.

One National Oil Company used the system to see if it would help them get a better understanding of a part of the world where they were considering exploring. “They got so much value out of the product that they decided to buy a subscription,” he said.

Geofacets could also be a source of finding oil, because of changes to the financial viability of different types of reservoirs over time. For example someone might have rejected or overlooked an area as having little potential 20 years ago which now they see as a promising shale gas reservoir.

It can also be used when looking for analogues – if you come across as a certain type of geological feature, you can look for similar formations around the world.

While many geoscientists are doing research using the internet in general, tools such as Google can require users to wade through a large amount of irrelevant information to find the specific item needed. Geofacets, thanks to having a more focused remit, just takes you to relevant, valuable information, Mr Veenstra says.

It also saves people from having to read through lengthy papers to find what they want. They can go straight to the map.

“Academics read papers: that’s what they do,” Mr Veenstra says. “But in a corporate environment you can’t expect people to read papers from start to finish. We expect Geofacets to boost subscriptions for our new content partners, as geoscientists who would rely on information they have in-house will see the value of what they might previously have considered as information for academics.”

The system

Companies apply to use Geofacets on a company-wide basis, with a negotiated fee.

You gain access to the text of papers on a read only basis, but you have to buy a sub-
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scription to the actual journal, whether via Geofacets or separately such as through corporate subscription, in order to download them.

There are no individual consultant subscription models, but Mr Veenstra says that such models are under consideration.

The tool is available with access to the complete worldwide database only – it is not sold by the region.

Source of information
Many of the papers have been written by academic geologists, working at universities, sometimes in partnership (and funded by) oil companies. However unlike commercial and exploration data, which companies will often keep to themselves until they have received the most possible value from it, this academic information is available for all to see as soon as it is published.

Currently, the vast majority of papers and maps covered by Geofacets are in English. As a result, while the tool has full global coverage Geofacets is constantly expanding its roster of papers in order to provide more content in all languages.

All of the journals which Elsevier takes information from are peer reviewed; the company is looking for publishing partners which work to a similar standard.

Indexing and searching
All of the maps are georeferenced, which means that the database knows exactly what part of the world they cover.

The indexing of papers is all done manually, adding co-ordinates to the map and various metadata.

The information is all indexed around basins, as the basic unit for searching for useful information, with the IHS basin classification used.

You can search for maps of a certain basin, and set different scales of map.

You can search for maps via words in the caption, or text around it.

The georeferencing process is not perfect (eg for maps of a higher altitude the co-ordinates do not match).

The maps are all quality controlled, in a very labor intensive process.

Adding more information
Elsevier is currently making partnerships with professional geological organisations, to be able to include their papers on Geofacets.

The first partnership was made with the Geological Society of London, signed in September 2011.

In April 2012 Elsevier signed a second partnership with SEPM, the Society for Sedimentary Geology in Tulsa: the information from this partnership went live in September 2012.

Another partnership announced in September 2012 was with the Society for Economic Geologists (SEG)(not to be confused with the Society of Exploration Geophysicists, which is a different organisation).

Geofacets also features a Wood Mackenzie overlay with information about unconventional gas and other Wood Mackenzie data.

The unconventional gas overlay provides commercial information showing expected break even prices for producing gas in that region (what price you would need to be able to sell the gas at, to have profitable operations). It covers shale gas, tight gas and coalbed methane.

The conventional oil and gas overlays can give information about economic potential of the region, showing how many exploration wells have been drilled, relative maturity of exploration in the regions, success rates (showing where risks are highest), development value (where overall net value of discoveries is high) and government percentage.
Making more from well data

How do you do more with the data you have, to help manage the safety and integrity of your wells?

By Dr Liane Smith of Intetech

Oil and gas operators are sitting on vast reserves of data that has the potential to transform the way they manage the integrity of their wells.

But many lack visibility at field or enterprise level because information relating to well production, barrier equipment and design is held in different departments in various formats and under different timelines.

These silos make it difficult for senior executives and management teams to compare and report on well integrity data. And the length of time this can take impacts on their ability to identify problem wells, make informed decisions and take remedial action.

With around half of all well workovers and shut-ins in mature fields caused by well integrity problems, this lack of visibility presents a significant risk and cost to the business.

The challenge is compounded by the fact many oil and gas operators have grown their wells.

Knowing your wells

The integrity of well barrier components is continuously threatened by the corrosive nature of the well fluids.

Scaling, corrosion and failed barrier equipment are all common issues.

Managing well integrity is much more than ensuring safety during a current activity. It is also about the sustainability of the equipment to operate safely for the full design life of the well.

Information on the status of safety-critical well barrier components must be completely dependable, and the performance of these components must be totally predictable, should a problem arise at any given point in time.

An operator must be confident that they know how their well barrier safety equipment is going to respond.

For example, if the operator shuts a subsurface safety valve, the operator must know with certainty that it is going to shut in the several seconds it is supposed to.

Sustained annulus pressure, where casing pressure rebuilds after being released, is the number one killer of wells.

It can lead to an external leak or, at worst, result in a blowout.

Even if no leakage occurs, the risk is that when pressure within the well rises above the design limit at which it is safe to operate, a failure of well barrier equipment can be too risky to repair and therefore the well has to be abandoned.

Poor quality information about annulus pressure creates a real possibility that incorrect and perhaps dangerous decisions might be made.

Disconnected information

Silos of well integrity information make it difficult to collate information for analysis and review, which in turns makes it hard to identify inaccuracies that would otherwise allow operators to pinpoint barrier components at risk of failure.

The large volumes of information collected automatically from instruments on a well using Supervisory Control And Data Acquisition (SCADA) systems is in essence ‘dumb’ or ‘grey’ data, because it is simply a set of readings that in many cases, is rarely interrogated or validated.

When compared against readings acquired manually (which tend to be more reliable, though less frequent), anomalies are often found.

Management dashboard

A cost efficient and flexible approach to viewing the data is to interface with third-party systems such as production data management and other types of database, e.g. WellView, SAP, Maximo.

You can extract the required information for presentation in a management dashboard.

This is effectively a graphical user interface providing a simple overview of key operating well and production data, but allowing users to drill through to more detailed engineering data as required.

This type of system allows operators to build on their existing investments and legacy data, by starting out with their basic information and then scaling the system accordingly.

For example, initial set-up might see the translation of well design data from various electronic and paper formats into an audited well design database that is accessible per well for managing and generating well handover documentation.

It might collate the results of routine and specialised leak testing of safety critical elements (SCEs) for monitoring and review.

Once basic functionality has been established, more sophisticated applications can be introduced, such as using production data to estimate corrosion damage to the tubing in a well, automatically identifying the presence of sustained annuli pressures and notifying users with warning traffic lights and email alerts, or risk-ranking wells failing to meet safe operational limits.

A traffic light warning system provides a simple device for highlighting wells at risk. These can be configured against a wide range of operating parameters and conditions that are to be pro-actively monitored on an ongoing basis.

A green, amber or red light provides a view of well status, whether it is being operated within its safe operating envelope and whether all well barrier components are intact.

Reports can provide a standardised format for the well integrity data being monitored to ensure better efficiency and clearer communication of well integrity issues across the enterprise.

Repairing wells

Most operators accept that certain well barrier component failures are inevitable.

Operational constraints may mean that they cannot be repaired immediately.

It can be necessary for wells with individual pieces of equipment not in full working order to continue to operate, provided risk assessment indicates the risk level is ac-
Managing software on new drilling rigs

As control software on drilling rigs gets more complex, it gets more important to have a formal ‘management of change process to follow when the software needs to be changed. Stephen Hadley and Christopher Goetz of Kingston Systems explain how to do it.

Managing software has long been a peripheral concern in rig operation. However as new rigs with increasingly complex control systems are delivered, effective software change management is critical in avoiding down time.

Software Management of Change (SMOC) is a set of procedures and policies designed to control, track, and understand changes to software systems for the purpose of increasing predictability, disaster recovery, auditability, and overall reliability.

Unfortunately, many operators are learning about SMOC the hard way through increases in accidents, data loss, unpredictable system behavior and non-productive time (NPT).

An industry problem
Managing software change is a new concept in our industry. It is taking time to learn to understand that software is an asset that needs to be controlled.

SMOC is not a form filling or access restriction exercise. Paperwork provides accountability, but unless the details of the proposed changes are well understood, problems are likely to occur.

Considering the risk of injury and damage that can be caused by incorrect operation, it is essential that the testing of even minor software changes be thorough and complete.

All the machines controlled by the modified program should be function tested as well as each system that it interacts with.

Special attention should be paid to emergency stop, critical operations, zone management, position limits and other safety interlocks.

Amount of testing
In a typical software company, a software release will be tested by a minimum of three people (Developer, Quality Assurance Department, and Client).

It will be deployed to around 5 systems before being released to production and retested at each stage (Development, QA, Client Test, Parallel test, and Production) before it is released for use.

Currently, the offshore drilling industry does not have anywhere near this level of quality checking.

This is odd considering the risks involved.

Often, the burden is placed on the owner to insist on a thorough retest after every software change.

Common problems seen in our industry include:

Bad Releases: Because of the nature of developing HMI (human machine interface) software, it is difficult to test the software on shore. Sometimes it seems as if the software was never tested at all, as it is “Dead on Arrival” and a local technician must fix it to make it work.

Technician Error: Some fixes are created on the spot by a local technician/software engineer. It is generally considered very bad practice in the software industry to...
Standardization is the enabler for our ability to integrate knowledge across the organization. Open standards from Energistics are the key to Integrated Operations being 'the way to operate' in Statoil.

Peter Eilsø Nielsen
Chief Geologist Production
Statoil
The software to control drilling rigs is getting more complex – and updating it can be a nightmare

have the same person both make a change and test it. Developers test things to see if they work, not to see if they are broken.

**Error Regression:** Often an upgrade patch from another rig is converted to be used on the rig. The upgrade patch can then overwrite any changes and fixes made on the local rig.

**Error Porting:** When a patch is installed on a rig, all rig specific parameters must be manually updated to match the new rig. This is an extremely error prone process.

**Installation Error:** Sometimes an update has multiple interdependent parts or a specific installation order. If the sequence is incorrect, the error may not be easily detected, causing problems later.

**Side Effect Error:** The new software may function perfectly but be incompatible with other software already in use.

**Network Error:** Installations often require the computer to be rebooted or the server restarted. If the restart procedures are not correct network communication problems can interfere with correct operation.

**Poor Testing:** Poor, incorrect or partial testing, limited by operational constraints, can effectively negate all previous positive efforts by the change initiator. To complete the process fully, pre and post change testing is required.

**No Recovery Plan:** When install or hardware fails, often owners are caught short lacking back-up and recovery plans.

**Risk of small changes**

It is a mistake to believe that small changes in software do not require the same level of diligence as large changes. A small change can present a greater risk than large ones where a complete engineering review is more likely to be performed.

Human nature often circumvents known best practices when the task or risk is seen as minor.

The weakness is especially prominent in pre and post testing.

Vendors often resist pre or post change testing, especially with small changes. Their technicians usually want to test only the changed functionality and not the entire system.

This drastically underestimates the amount of testing needed to ensure the changes made do not have unexpected side effects like regression.

This resistance puts the burden on the owner to insist on a retest of the system.

**Management of change**

Management of Change is a well-executed concept that can be effectively applied to software.

A good Software Management of Change (SMOC) program consists of a set of policies supported by procedures and tools to control and track changes to software and its configuration.

To be effective it is funded, supported by the executive and tied to existing maintenance programs.

SMOC allows management to make educated decisions about what program changes are being made, why, and what they will affect. It also enforces implementation planning, testing and recovery procedure for changes along with an audit trail.

Some key components include:

- **Clear accountability and communicated roles and responsibilities** from Offshore Installation Manager (OIM), Electrical Superintendent, to electronic technician (ET).

- **A registry of installed software**, logging version and configuration changes, giving a list of rig software assets at any given time.

Christopher Goetz is the founding director of Kingston Systems bringing 20 years of oil and gas experience to the field of rig auditing and operations.

Stephen Hadley is an Senior Inspector for Kingston Systems, a Control Systems inspection and auditing firm based in Houston. Stephen is a computer scientist who lives with his family in the Dominican Republic and enjoys panning for gold in his spare time.
Procedures to ensure systems are recoverable and that equipment failure will not result in serious lost time.

Good and bad
A good SMOC program provides increased system uptime via stability, predictability, and accountability. It ensures only tested well understood software changes are installed, and that any changes made can be recovered in a timely manner. Software changes should be planned, monitored and authorized by appropriate personnel.

A strong SMOC will deliver improved vendor relationships, better disaster recovery and a strong maintenance crew.

A weak SMOC program will likely result in increased NPT, unexplainable incidents with indeterminate causes, and an over reliance on vendors.

With more uncontrolled changes increase the likelihood of unexpected behavior and regression of previous patches. These strain vendor relationships and raise issues regarding liability and data loss.

Case Studies
Lack of planning: Software upgrade is installed leading to a collision between the top drive and the top of the drill pipe because the update was designed for a rig with a shorter derrick.

Upgrade installation failure: A Software Change Request was filed and approved. Time was allocated under the Permit to Work process and other users were locked out of the network and from access to effected machinery.

Unfortunately, the technician was unknowingly provided with a bad release package. To further complicate the situation, no offsite support was available.

When contact with the home office was reestablished, the missing files were sent but blocked by antivirus software.

Eventually, an alternate route for software delivery was found. After the installation was completed, it was found to be incorrectly programed and was of no use.

Several hours of lost time doing tasks that should have been done offline, preventable through better planning and communication.

Lessons Learned
These case studies emphasize the importance of SMOC and the need to prevent the common problems needlessly encountered throughout our industry.

Vendor Responsibility, Owner Accountability: Good SMOC procedures allow management to control installation processes and for vendors to include the owner in the planning and execution process.

Pre & Post Installation Testing:
Technician making and installing the changes should not be doing the testing as they are prone to test for items they changed. Rechecking of functionality across the entire system is critical as there are often unexpected side effects. This is a critical step and requires management support.

Understanding the Interconnectivity and Interdependence: System complexity is often underestimated. Technicians are often specialists in a very narrow subset and are unaware of possible consequences to other systems.

Good Restart Procedures: Servers and terminals sometimes need to be restarted in certain orders. Restarting a server without reinitializing the connected terminals may cause the terminal to hang up after having lost its connection.

Good back out procedures: After a failed update, it is important to be able to restore the system to its original state.

Cleaning frac water with electrical pulses

Cleaning up frac water is a major expense in fracking jobs - but OriginOil of Los Angeles believes they have found a lower cost way to do it.

OriginOil, Inc. of Los Angeles has developed a technology for cleaning water using electrical pulsing.

It can be used for cleaning frac water (water used for hydraulic fracturing of wells), or produced water (water which is produced from an oil well).

The system was evaluated by Pacific Advanced Civil Engineering, Inc., a civil engineering consulting firm specialising in water, based in Fountain Valley, California, using a sample of produced water from a Texas Oil Well, which PACE supplied.

PACE found that the system could reduce "chemical oxygen demand" (COD) of frac water by 98 percent. Chemical oxygen demand is a test to indirectly measure the amount of organic compounds in water (because nearly all organic compounds can be oxidised to form carbon dioxide).

So this means it was removing 98 percent of the organic contaminants in frac water. It can do this in a single pass.

The pipe was bent out of position and was in danger of popping out of the vertical pipe handler gripper arm. The upper stop limit set point had been unknowingly changed by the software upgrade.

Poor testing plan: A software change was made to zone management settings and was retested between two machines. The interaction with a third machine was not tested and caused a collision resulting in injury risk and 2 months of critical machinery down time.

Upgrade installation failure: A Software Change Request was filed and approved. Time was allocated under the Permit to Work process and other users were locked out of the network and from access to effected machinery.

Unfortunately, the technician was unknowingly provided with a bad release package. To further complicate the situation, no offsite support was available.

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Eventually, an alternate route for software delivery was found. After the installation was completed, it was found to be incorrectly programed and was of no use.

Several hours of lost time doing tasks that should have been done offline, preventable through better planning and communication.

In the third stage, the particles can then be raked off and processed.

No chemicals are required.

The reactors are controlled by a SCADA control system. The algorithms are developed for the type of produced water being processed.

In future it will be possible to make real time adjustments to the pulse characteristics for the specific water parameters, for maximum efficiency and minimum energy usage.

The resulting water might need further treatment (such as filtering) before it can be put into ground water, depending on how much oil there was in it to begin with and the final water quality required.

There is a possibility that the system can provide an additional revenue source, if the produced water creates enough hydrocarbons that it their value exceeds the cost of treating the water or pumping it back deep underground untreated (which is what hap-
The company recently received an order for two systems from the US Department of Energy’s Idaho National Laboratory, to use in a demonstration unit. It has built systems with a capacity of 150 gallons per minute (216,000 gallons or 5,140 barrels per day) to remove algae, currently being delivered to a “demonstration scale” algae production site in Australia. The company is currently planning to test a 60,000 gallon per day / 1,430 barrels per day unit in the field for water treatment.

The equipment can be installed inside 2 x 20 foot box containers, with all equipment, piping, electrical power and controls placed inside the containers. To develop its business in the field of cleaning frac water, it has set up an oil and gas division, and appointed Gerald Bailey, former president of Exxon for Arabian Gulf, Abu Dhabi and UAE, as "Industry Advisor" to the division.

“I was able recently to observe OriginOil's lab-scale frac flowback water treatment process,” said Dr. Bailey. "The process is quite an achievement and has so much potential. I am looking forward to helping get this process into wide use in the oil and gas industry as a highly portable, high-flow and chemical-free way to maximize oil recovery and re-use the huge amounts of water used in oil exploration today."

The U.S. Department of Energy estimates that an average of three barrels of contaminated water is generated for each one barrel of oil produced, OriginOil says.

Whilst in fracturing, 50% to 80% of frac water will remain in the ground, 20% to 50% will return to the surface as frac flowback water. This water is contaminated with hydrocarbons, salt (brine) and other contaminants.

PACE estimates that the normal cost to remediate frac water to class B purity (ground water grade) is roughly $0.21-0.26 per gallon ($9 to $11 per barrel), and for disposal in deep wells, $0.11 per gallon.

The multi-step PACE process to achieve ground water grade that includes OriginOil's as a first step, is estimated to cost $0.07 per gallon ($3 per barrel).

Petroleum extracted from West Texas frac flowback water using OriginOil's lab-scale algae harvesting system. OriginOil Labs, 3 April 2012

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The digital value engineer

Upstream clearly needs competent professionals who can take an operation to higher levels of performance using petroleum engineering, IT and business savvy, writes Dutch Holland.

Whether those pros are called Digital Engineers, Digital Petroleum Engineers or Business Value Engineers, the basic idea is the same: to achieve continuous improvement in processes for business value.

Preparation would not be the same, however, since adding business principles to either the professional engineer or IT pro would be considerably easier than requiring the engineers to become IT pros or vice versa.

Today’s upstream energy industry is struggling to define and refine jobs called digital engineers or digital petroleum engineers.

Yet this issue has rarely been discussed in literature or at conferences.

Most significantly, while the topics have been wide-ranging, subtopics surfacing the least are “Business” and “Business Value.”

Let’s proactively introduce the subject of business value into the mix of opinions and preferences; the result should be interesting.

Digital engineer’s work

Science mixed with business is not science—while engineering without being mixed with business is not engineering.

This is the difference between oilpatch scientists and engineers.

Based on the definitions of engineer, not connecting their work to business value would be an oversight.

When the subject of the digital engineer topic is mentioned or discussed, the context is usually the difficulty companies are having in getting technology in place that will be used to generate business value.

Typically this topic is talked about in the context of “the people problems” that go along with technology integration into an upstream organization.

For those who have worked the technology integration problem for many years, it tends to crystallize not in terms of people problems but in business terms.

Improving processes to increase efficiency

Consider an organization with the idea of improving a work process in operations to increase productivity, efficiency or business value.

It’s a 3-piece puzzle (see diagram below)

The first piece involves thinking about the desired business value as the result of a disciplined program focusing on improving business (or technical) processes through enablement by information technology (IT).

Operations Readiness Project: the second piece of the puzzle is the hard work of designing the improved processes, in concert with IT, and preparing the operations organization to be ready to use those processes to generate business value.

Technology Readiness Project: the third piece is the readying of selected technology to enable the re-designed work process.

While readying the technology seems to be the “hard stuff” which technical professionals can sink their teeth into, the other two pieces actually are hard stuff too, requiring precision in work process engineering and job design.

Competencies of the digital engineer

If the digital engineer work domain is described as above, needed competencies that jump out are Business Principles, Petroleum Engineering (PE) and Information Technology (IT).

What’s new is the addition of Business Principles to the known mix of Petroleum Engineering and IT.

This business addition has to do with principles associated with work process design and engineering along with Program and Project Management.

While the three competencies are obviously all needed to work the kind of process improvement described earlier, all three competences do not have to reside in a single person.

A three-person team may be able to pool resources and have what it takes for the job.

On the other hand, two persons might be an ideal fit as long as both have deep technical expertise in either PE or IT and at least one has expertise in the business principles, ie process architecture and engineering as
well as program management.

The curriculum for formal study could include (see diagram above):

**Petroleum engineer**: physics and engineering

**Business value manager**: Work process architecture, work process engineering and program management and program management

**Information technologist**: Information technologies and data management.

Business value manager
The one part of the curriculum that might need further explanation is Business Value Manager.

Work Process Architecture: The operations side of the upstream business can be described as an organized set of work processes (architecture) showing day-to-day work of the organization and its employees. A work process architect would be an expert on the work process architecture, knowing interdependencies, recognizing strong and weak points and being able to identify “leverage points in the architecture” having the highest potential for improvement with better design and/or IT.

Work Process Engineering: Work process engineering includes expertise in identifying, improving and streamlining workflow as well as identifying the needed interfaces with digital technology, in order to produce additional business value.

Program Management: Program and Project Management provide the needed techniques, tools and discipline to direct a program of work that includes process re-design, selection of technology, and both the “readying of the technology for the organization” and the “readying the organization for the technology.”

Moving toward Digital Value Engineering
Realistically, a strong petroleum engineer can become a business value engineer faster than can an IT professional, adding business principles discussed in this article to the engineer.

Moving toward an organizational competence should probably follow a standard three-phase model like the one below.

**Phase 1** – awareness and education of business value role

**Phase 2** – conducting pilot projects for business value

**Phase 3** – widespread integration of business value management

The idea would be to start now with exposure to, and experience in, projects that successfully integrate digital technology into an organization to achieve business value.

About the Author: Dutch Holland, PhD, is a Houston-based Management Advisor who has focused much of his career on helping companies integrate new technology for business value. Dutch is the author of the new book “Exploiting the Digital Oilfield: 15 Requirements for Business Value,” available at Amazon.com.
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