Finding Petroleum

Making software centred around experts

- Matching experts' mental modelling
- AI to support geoscience drudge work
- Helping experts work with safety data
- Making search more interesting
- Software led optimising maintenance decisions
- Virtual reality to support expert work

Expert-centric digital technology - January 24, 2019, London

Special report

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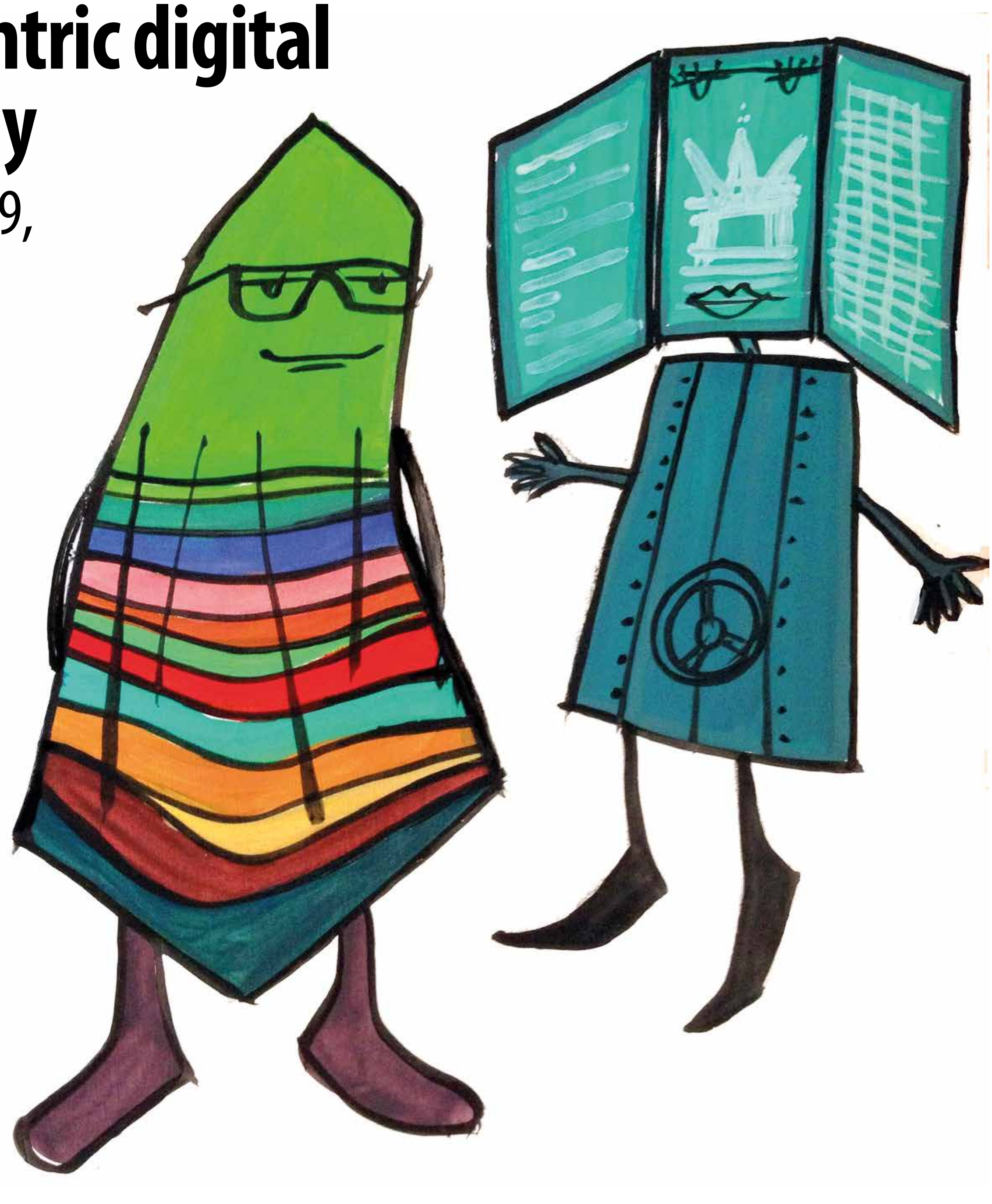
London



Can we make software more expert-centric?

Can we build software so it better supports the needs or performance of our oil and gas experts? Our forum in London on Jan 24 2019 explored ways to do it

The oil and gas industry has many experts working daily with software, across exploration, drilling and production activities. The software will analyse data, show them information on a screen, give them information to enter into a box, or give them tools to work with data or a design, or help people transact, or work with large databases.

What the software doesn't usually do is help them better understand what is happening across their wider domain, whether they are in exploration or operations. And situation awareness could be described as the critical factor for both improved decision making and being able to become a better expert.

For example, software truly designed around the needs of experts would help explorers, drillers, facilities operators and production engineers get a better understanding of what the impact of their past decisions has been, or whether their past predictions came true, so they can make better decisions and predictions in future.

Finding Petroleum's forum in London on Jan 24th explored ways that software could be used to better help here.

Topics we looked at included ways computers can better support the mental modelling which experts continually do to understand their domain. How artificial intelligence can automate the 'grudge work' which experts do, so they can get a deeper understanding faster. How data from multiple sensors be brought together in a way to make the overall running a facility easier to understand. How we can make search (particularly for exploration) more likely to bring up intriguing or stimulating results. How we can make predictive analytics more helpful in decision making.

All of this can lead to higher performance work which is also more rewarding and enjoyable – a win for both the company and employees.

This is a report from the the Expert-centric digital technology event - January 24, 2019, London

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Note:
Some of the slides and videos from this event can be downloaded free from the Finding Petroleum website event page
http://www.findingpetroleum.com/event/ce65d.aspx

AI to support subsurface experts – David Bamford

Artificial Intelligence is commonly viewed as a replacement for human intelligence. But by seeing it in this way, perhaps we miss the most useful application for it, automating 'grudge' work. David Bamford, a former head of exploration with BP, shared some thoughts

There is a growing school of thought among younger oil and gas professionals that the future is about dominance of AI in everything, and anyone sceptical about this is just showing resistance to modern technology, said David Bamford, a former global exploration lead with BP.

Some oil company exploration managers are starting to say they want to do all seismic interpretation with AI. "Personally I think that's a mirage," he said.

A better way to find a role for AI in exploration might be to ask what explorers are really paid to do, how much of their time is spent actually doing that, and whether an AI might be able to help them spend more time on it, he suggested.

All of the subsurface disciplines – geoscience, reservoir engineers, petroleum engineers, petrophysicists, could be together called "subsurface detectives", because their role is also try to figure out what is happening in the subsurface, he said.

David Bamford

For a typical oil and gas company, the overall challenges could be described as increasing the recovery factor in their producing field, making better use of reservoir simulators, finding the 'sweet spot' in an unconventional reservoir, understanding how the petroleum system in a much explored basin actually works, and determining which play or basin the company should enter.

These are "quite sophisticated questions," he said. "That's what experts are paid to do. But is that what experts actually do all day? Everybody knows, the answer is no. "

A significant minority of the time might be spent on that, but most of the time could be described as drudgery, working through data such as cores, well logs, geochemical analysis and flow measurements. Trying to work out whether it can be integrated – or even found – when data might be last seen under someone's desk who left a few months ago.

Subsurface experts try to understand their domain by using the data to build up models of how they think the subsurface 'works' – what it looks like, how it became that way, how the petroleum system works. These can range from models which exist entirely in someone's head, to computer models of various kinds. In the past, subsurface models were made from layers of tracing paper.

So it would be useful to ask whether machines can take over more of the drudge work of finding data, finding if there is anything useful in it, and helping compile this data together into a model, he suggested.

Ideally such a model would have all the available subsurface data integrated together, including seismic and well logs. It would be a kind of 'digital twin' of the subsurface, similar to the 3D 'digital twins' which people working in oil and gas facilities have been building.

There have been many efforts to integrate subsurface data, but Dr Bamford says he has never seen anyone build such a data integration system.

All basins and fields are different, so the software would need to be very flexible. And it is unlikely that the final interpretation could ever be done by machine, because there are so many variables involved. So human expertise would be working together with the machine to build it.

Since a lot of the work with seismic interpretation and processing is about following rules and understanding patterns, perhaps it is possible to automate much of the work.

Companies are talking about doing it, "but nowhere do you actually see anybody doing it properly," he said. "I have not seen anything that looks significantly different in wholescale interpretation than what I was seeing 10 years ago.

Mental modelling and expert-centric software

Perhaps the key to building expert-centric software is matching the software with the models which all experts form in their heads about how their domain works – and the same model based approach could be applied to building the software itself, said Dimitris Lyras of Ulysses Systems

Computers and people do not think in the same way. Computers get their (sort of) understanding from processing large amounts of data. People understand the world by building models in their minds, which are endlessly enriched with more experience, he said.

So perhaps the key to making expert-centric software is working out how to bridge this gap – but instead of expecting people to think more like computers, having computer systems which are more supportive of how people think, said Dimitris Lyras, director of Ulysses Systems.

Ulysses Systems is a software company working largely in the deep sea maritime industry. Mr Lyras also runs his own shipping company, Lyras Shipping, and designed the software around the needs of experts in the shipping industry.

To consider the difference between how people understand things and how computers understand things, consider two people discussing a subject they are both knowledgeable in. They convey a great deal of broad understanding, but with very few words. Both people have similar models, and in conversation they are exploring where their models differ.

One computer struggles to share even basic information with another computer. Their data is usually stored in rigid relational database boxes, and the computer has no meta-understanding of what that information is, and what the other computer system might need.

To illustrate how people build models, consider that every person has their own sophisticated model of how human characteristics change as a person ages. But the most a computer could do is follow instructions about how to treat a variable called age, for example by programmed to deny admission to a club to people with an age outside a certain range.

Meanwhile, computers provide a great deal of value doing what they do best, processing and moving data around. This can involve processing transactions, or doing calculations to optimise assets. But in doing this, the computer is not usually helping anyone understand a complex situation, nor does it host any understanding of routine real world situations.

Also consider the differences between people and machines in storing information. The human brain is evolved to understand multiple moving parts and variables, where the mix of variables continually change, because most real world situations are complex.

Computers are usually designed to only handle information which they can put in inflexible boxes, known as relational databases, with a limited number of variables and limited capacity to evolve the data model. The relations between the elements are very difficult to change after the database has been built, and the computer has no understanding of them.

When people work with digital technology, as they do everywhere now, most of the focus is typically on trying to get the computer to function.

This means shaping information in the world so it can be conveniently digested by a computer, trying to constrain complex real world information into a format which fits into a relational database, he said.

Alternatively, we could be focusing our energy on creating methods which help computers get a better understanding of their world. Technologies and methods do exist to do that, but they are not being used anywhere near as much as they could be.

The limitations of the relational database view of the world can be illustrated with a typical oil and gas example, a system for managing maintenance of equipment, and making decisions about what maintenance is required.

Ideally, such a decision would be made on how the equipment has been used, and any indication of a change, such as a component making a different noise or vibration pattern.

But in today's oil and gas industry, maintenance decisions are largely based on a fixed schedule, based on specific interval of how long a part can usually be operated before it is maintained. And the decision maker has no knowledge about how the interval came about, nor of any domain knowledge that may have been applied.

The way that people and computers build up an understanding of a new area is completely different.

When people want to understand a domain, they want to start small and gradually get a bigger and bigger understanding, he said. But when software wants to build something, it starts with big questions, 'such as what size will your user base be', 'what software architecture do you want to use' – and everything subsequent

Dimitris Lyras of Ulysses Systems

is made on these opening questions.

Opening questions could instead be 'is the process you are emulating in the software similar to another commonly recognised process?', 'given your initial development goal what further information should we gather to support it?', 'Is there any variation in context?'

There is not discussion of fixed architectures, no discussion of technical constrains until a better understanding is reached of the logical process. Much the way we do when we try to learn, he suggested.

Analytics

Data analytics gives another good illustration of the difference between how people and machines understand a domain, he said.

Data analytics people build algorithms to try to identify a trend in data, or find inflexion points, or other analytics tasks. The algorithm is a series of instructions a machine can understand. But without expert involvement, the results of the algorithm are rarely relevant to the real world.

Mr Lyras has seen analytics attempted many times in his own domain, ship chartering, understanding the decisions made by cargo owners (such as oil companies) and tanker owners.

"People try to understand the chartering business by looking at the data and isolate a few trends. Then they realise the trends identified depend on hundreds of variables, and unless they are related, the trends are of no use to anybody. Then they start listening [to the domain experts]," he said.

Understanding computer systems

A related topic is making the computer systems themselves easier to understand. This is much easier to do if the computer systems are built around models. Model-based software is also easier for domain experts (who are not computer experts) to understand.

As an example, consider autonomous vehicles, which have a great deal of complex code defining what a vehicle would do in a certain situation. The engineers building it need to understand this code well enough to predict how a vehicle would behave given a certain situation, to be sure it would not hit a person.

Making computer software easier to understand is also essential for cybersecurity, since hackers thrive on the obscurity of software, and ease of which malicious code or activity can be hidden.

Furthermore management and security of private data needs to be understood by regulators.

Another challenge involving understanding computer systems is making one computer system interoperate with another. To do it, stakeholders need to understand separation and propagation of processes to precisely determine similarities and co-ordinate behaviour. Snapshots of multiple process statuses via objects in a conventional API, without process propagation analysis from one system to another, is not enough.

The best way to make computer systems easy to understand is to build them around models (which can be as simple as boxes and arrows on a piece of paper). If the software closely follows the model, it means that if you understand the model, you can understand the software.

Nearly all software development begins with a model of some kind, but then the emphasis moves onto writing code for the different model elements, and because the code itself mixes data organisation, retrieval and logic together, it is disjointed and definitely not modelled. It is hard to understand even by the parties who contributed to the design because of this mixture of concerns.

There are efforts to make it possible to make software automatically from models, known as 'low code' or 'no code' – nobody need ever see or write any code at all, just logic as we do in mathematics.

Eigen – helping experts work with safety data

It is easy enough for companies to fit oil and gas facilities with sensors and generate lots of data on safety related issues, but a much bigger challenge to use the data to drive better decision making. Software company Eigen has developed an approach based around data modelling

All oil and gas operators worry about accidents – and all struggle to make sense of large amounts of data which attempt to tell people what is going on. UK software company Eigen has developed an approach to help oil and gas companies work with the data and get a better understanding of their safety barriers, based around a core data model.

Murray Callander, CEO of Eigen, presented the software with a live demonstration to the conference audience, of a safety barrier management system for an oil company operating on the Norwegian Continental Shelf.

Safety barriers, as used by oil and gas operators, are not physical objects, but a mixture of sensors and procedures designed to prevent any problem developing to the point where it becomes catastrophic.

Managing them can be complex because it isn't always obvious what function any sensor performs as part of the barrier. For example the purpose of a gas detector in a wider safety barrier might be buried in a document nobody ever reads.

Eigen's software does not make any determinations itself about safety itself, but it aims to help companies understand whether their safety systems function as they have been designed to, and improve the internal conversation about what improvements or maintenance needs to be made.

Murray Callander, CEO of Eigen

The software aims to automate the usual process of doing safety barrier checks in oil companies, with a monthly review by an engineer, compiling a complex spreadsheet copying data from multiple data sources, and distilling it all into a PowerPoint slide, Mr Callander said. This manual work is sometimes known as "data munging".

The core of Eigen's software is a data model, showing how the various data available can fit together, including data from sensors and software systems. Based on this model, it is possible to show the data in many different views, according to the needs of different individuals.

For example, you can see the biggest impairments the software has identified, which have not yet been subjected to an expert review to assess the risk. You can drill in further to find out more about what specific equipment or "tags" are causing the impairment, or why it is categorised as such. For example, it could be overdue maintenance task.

If you have designed your barriers around multiple safety layers ("Swiss Cheese" model), you can monitor the current status of the different layers. This is important in understanding how a problem (such as a small leak) might affect multiple safety layers, and make the holes larger.

For example you might be aware of a malfunctioning piece of equipment you rarely use and think it is no big deal. But the software might tell you that this equipment is the single barrier you have in place to stop a big problem occurring, and so you really need to fix it.

You could bring up all of the problems which a certain system has.

You might be an individual given the responsibility of ensuring that all the gas detectors on a plant meet a certain performance standard – and you can use the software to show the current status of all the gas detectors.

You might want to calculate a Key Performance Indicator of the number of inhibitors you have impairing safety functions.

None of the systems use any analytics or artificial intelligence. It just aims to present data integrated together in a way which matches people's mental models of what they need to look at.

Prioritising problems

Some kind of prioritisation system is necessary in safety equipment management, otherwise a failed emergency light or delayed sensor calibration is given the same priority as a critical pressure sensor which has malfunctioned.

A gas detector might have a different role depending on which way the wind is blowing (because it is then detecting gas leaking from a different place). So the criticality of the detector may depend on the wind.

The system can also help you identify when a component failure is more critical than it immediately appears. For example if the failed sensor is your only system for detecting a gas leak, which could be catastrophic.

Developing the software

Much of the development work went into building the core data model, which took 4 years, from 2009 to 2013. Eigen is now on the second generation of its data model.

The model can take data from sensors and software systems, such as work orders, safety cases, and personnel competency data.

One lesson the company learned while building the model was not to be too ambitious about data quality or strictness, Mr Callander said. This slows down development and makes it harder to get useful outputs. It is usually better to start with something and improve it over time, as you realise specific areas where the model does not deliver the depth of understanding people need.

The hardest part of the software development was making the final data display meaningful. It involves a large amount of time from "high bandwidth people" trying to make everything correct. But if there are obvious errors in the data presentation, people lose confidence in it.

The underlying software is all open source, and runs on the Neo4j Graph Platform.

Can we make search systems more interesting?

At least 20 per cent of searches made on enterprise document management systems are exploratory, rather than looking for something specific. And an exploratory search might be more effective if it could deliver something which catches people's attention, said Paul Cleverley, associate lecturer with Aberdeen's Robert Gordon University

Explorers have always said that oil is found "in the minds of people", not by technology or documents, said Paul Cleverley, associate lecturer with Aberdeen's Robert Gordon University.

So when explorers are searching for information, it might help if the search results stimulate people's minds, taking their interest in a direction they had not expected.

The primary function of search should of course be to give people what they are looking for, but Mr Cleverley has been exploring the idea that corporate search systems could give people a little more.

While 80 per cent of enterprise searches are looking for something specific – 20 per cent of searches are just exploring. So the search engine is acting as a kind of "creative assistant," stimulating new needs, he said. But they are not designed in this way.

Paul Cleverley, associate lecturer with Aberdeen's Robert Gordon University

It is worth noting that search technologies developed for the consumer world do manage to stimulate people, partly through their 'voting' systems, where you might find something you really like based on the fact that many people before you have chosen it, and the search engine has moved it to the top of the results.

But in the enterprise world, the goal is often not popularity, but presenting people with something no-one has seen before. Voting type search results achieve the opposite.

Alternative methods

Mr Cleverley presented his research into alternative ways a search could be managed. The search results were evaluated by asking geologists to score them for usefulness.

The research looked at 3 algorithms. Algorithm A was simple, ranking documents by popularity and frequency of the target terms, such as steel, corrosion, resistance, stress. Algorithm B looked more at two-word pairs and compound terms, such as "cathodic protection." Algorithm C looked at terms from single words often seen together, such as micro climate or stuck pipe.

Algorithm B was rated as "most useful" by expert participants. Algorithm A was second most useful, but many people thought it was too general. Maybe it was useful for novices.

Algorithm C was thought perhaps more for expert users, who might be searching for these two word terms, he said.

The study did indicate that search engines could work in different ways, depending on whether the desired results were general, expert, situational, broad, rich or intriguing, he said. "Compared to existing search tools, geoscientists felt these techniques would increase their ability to come across interesting, surprising and valuable information."

In one example, a search result related to ophiolites led an exploration team to consider a new geological element which could have an impact on the final result. The search did not involve any new content, just new ways to interrogate existing content.

It may be helpful to consider the different ways information can stimulate people, such as an unexpected trend or event, or telling people something they did not already know. It can be an occurrence which conflicts with the information you already have, such as an oil seep in an area you did not think contained source rock. Such information pushes people to update their mental models of how their domain works.

If we define information itself as something new (if telling people something they already know is not considered information), then we can say that deep expertise itself is developed through (to some extent) being surprised by information.

NOV - optimized maintenance decisions – software led

One of the toughest decisions in offshore operations is when to do maintenance. Developing software tools to help is far from easy. Julian Zec, chief engineer and manager condition based maintenance and reliability with National Oilwell Varco, explained

For over a decade, oil and gas companies have been trying to change their maintenance work from being based on a time fixed schedule ("time based") to doing maintenance only when it is required ("condition based"). But this is far from easy, even with the help of sophisticated software, explained Julian Zec, chief engineer and manager condition based maintenance and reliability with National Oilwell Varco (NOV).

There is a big prize for doing it right. Drilling companies will typically spend $20-40m over 5 year periods on comprehensive drilling equipment maintenance work, which may not be necessary. And of course the costs of failure of a drilling rig can be colossal, and doing the right maintenance work can much reduce the risk of this.

But on the other hand, improved maintenance procedures do not obviously make a difference to the bottom line. Planning maintenance on a fixed schedule is much simpler than using software to make a decision about when to do maintenance. And the software might make the decision making harder, such as if it informs people that they have a 30 per cent risk of a failure in a not particularly important piece of equipment over the next 3 months, and they only need it for 30 days.

The analytics needs to do more than just identify what is happening, it needs to help someone decide what to do about it – for example tell them how much time they have to fix a problem before it gets more serious, he said- and how to effectively organize work getting there.

And bringing in new technology requires changes in how organisations work, which usually no-one is keen on.

NOV provides comprehensive packages of drilling equipment for drilling rigs, with 600 packages provided in the last 12 years. It recently started offering more proactive support services, analysing data from its drilling equipment, and the service is now provided for 55 offshore drilling rigs around the world, covering 1200 pieces of equipment.

It includes diagnostics and maintenance support for the drilling equipment, the subsea equipment (including blow out preventers and risers) and lifting and handling equipment/cranes.

The company first tried to find a third party software system which could be used to manage the data and support decision making, but after testing over 15 different monitoring and asset management packages, found that none of them was a match. "It was too general, it was not covering the areas we need, and we didn't have any control over it," he said. So the company decided to develop software itself.

A first challenge was deciding what data it actually needed. A typical drilling rig has 60,000 pieces of data provided every second. But "maybe 100" of these are really useful for maintenance of equipment piece, some times as few as 10.

That led to the next big challenge, working out how to best present the data to support decision making.

Maintenance decision makers do not need fancy software or visualisations, they just need the most relevant information at the right time for their decision making. They often use a spreadsheet to do their data analysis.

To generate this data, an engineer has to take account of large amounts of historical information, repair records, engineering documentation, sensor data and analytics data, and finally make a decision, and issue a work order for the work.

So the most useful software might be software which can automate the tasks of building their "spreadsheet" for them, so they do not have to spend hours "wrangling" data.

Once a decision to do maintenance work has been made, the company needs to mobilise a team to do the work, and make a plan which complies with all regulations and requirements. "You need to look at the whole picture at the same time," he said.

The same software can be used to diagnose unexpected occurrences or anomalies, to try to explain what is going on.

Developing a decision making system based around condition based maintenance involved some re-organisation of the company, putting together new teams with domain experts in charge, with people all over the world, including maintenance people, customer service people, design engineers and customers.

Varco's Julian Zec

The best way to approach the challenge is to see it as a continuous journey of improving maintenance decision making, involving changes to the organisation, changes to the expert, and changes to the software, he said. You need to keep focussed on the goal of improving condition based maintenance, being able to tell people exactly what they need to do. If you can't explain why a change will improve something you should stop.

NOV was involved in two joint industry projects involving DNV and ABS, who would ensure that results have a high level of quality and make sense. "Without third parties input it is very easy to go blind," he said. "Data science always try to solve something which is interesting first but not necessarily valuable."

Another challenge is managing the enormous amounts of information, including historical information which might give indications about trends. NOV has decades of engineering and project information, but much of it has no common governance system, he said.

NOV has developed standard data structures for all of its equipment, so there is a standard way to record data about equipment reliability, the criticality of the component, and the failure modes. It took many lengthy meetings of experts to get this right, he said.

To develop the software, reliability experts sit next to analytics and equipment experts, rapidly experimenting and building prototypes for something which would convey useful information to a maintenance manager.

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How virtual reality can support expert work

Paul Helm, Associate Technical Director with Geologix SI, and a former head of oil and gas with HP, has been exploring ways virtual reality can support expert learning in oil and gas

Virtual reality can support learning in many interesting ways, far more than just helping someone familiarise themselves with a piece of equipment, said Paul Helm, Associate Technical Director with Geologix SI, and a former head of oil and gas with HP.

"Most companies struggle to understand how and where to use it. Talk to online gamers, they'll give you the answers," he said.

Mr Helm built a virtual reality model of an oil and gas facility, based on a complex engineering model, with over 10m graphical elements, all pipelines and cable runs.

As you walk around the virtual facility, you can see real-time data from a historian or sensors alongside the object in discussion, such as tank levels or rotation speeds.

You can walk around the virtual facility with colleagues, discussing it as you go.

This tool can be very useful to remote staff involved planning maintenance work, who can't necessarily get a good understanding of the task from the paper documents of the facility, he said. With a virtual model they can see what it will look like when the work is being done, including with scaffolding and cranes.

The engineering model is based on CAD data, but it could also be based on photogrammetry or LIDAR models.

VR is a tool, a means to an end, not an exclusive new working environment. People would probably not want to wear a VR headset for long lengths of time, so perhaps it is most suitable for short (15 minute) meetings, he said. Put on the headset, do what you need to do, take it off and carry on with your (non-VR) work.

It could be possible to build a subsurface version, although it could be tricky working out which elements of the subsurface you want to have as transparent and which areas translucent (appearing solid check). But "VR and translucency don't go together, technology performance being an issue in such cases" he said.

Or the subsurface can be shown as a mesh, and you can cut parts out or take slices to see what you want.

Collaborative work environments

The same technologies can be used in the oil and gas industry, to develop collaborative work environments. Mr Helm has built virtual "integrated operations centres". They are similar to the "big room" integrated operations centres which many oil companies have, with people from multiple disciplines looking at the same data on big screens. But there is no expensive physical infrastructure or travel needed, everyone can work in their homes using a VR headset.

In the virtual integrated operations centre, you can see yourself and your colleagues as avatars in the VR room on the screen. If you look at a piece of data on a virtual screen, your avatar looks up so your colleagues can see what you are looking at. You can also talk to your colleagues (using VOIP). This idea is maybe best understood by watching the video of Mr Helm's talk.

Training firefighters using virtual reality

Paul Helm, Associate Technical Director with Geologix SI

The virtual integrated operations centre includes software running geotechnical applications, drilling software, and capability to interact with 3D models, such as core samples or resistivity models, and see real time data such as weather information. You can touch a virtual screen.

Education

Mr Helm conducted a project with schools near his home in Cumbria, UK, initially to try to encourage children aged 9-14 to take more interest in science, technology, engineering and maths (STEM).

He put together a simple problem involving a virtual reality machine, involving pulling levers and turning dials. The problem could be tackled at different levels, where the 'red' level meant they were given no instructions at all. See image on following page.

About 6000 pupils tried the problem over 2 days, taking no more than a minute each. The time was constrained because of health and safety concerns for and the possibility VR can cause headaches if used over longer periods with children, if the headset is not adjusted for the distance between their eye pupils or focussed properly.

Many people learn best when they are able to try different things out in pursuit of a goal, and that is something virtual reality can support very well.

The children scored their experience somewhere between "awesome" and much better than that, Mr Helm said, mainly because it was something new and exciting. But an unexpected benefit was that teachers saw they could recognise certain characteristics in the children which would otherwise take months to figure out, for example identifying the children who were good problem solvers, or the ones which just did the same thing over and over again although it wasn't working. Some children were better at taking instruction, and some had poor co-ordination or spatial awareness. VR makes it easy to quantify these factors, he said.

Mr Helm also tried out a learning tool for firefighters in his district of Cumbria, so they could improve co-ordination and better assess risk. The firefighters in this region are mainly 'retained' so not full time, and geographically dispersed over a large region. This raises challenges when scheduling training together, even more so when training for rare or complex fire scenarios.

With the virtual reality tools, they can continually refresh their skills, and also be put into situations they think they know, but which are slightly different, for example when an instructor introduces with a sudden change in different wind direction sending the smoke in a different direction so changing the immediate risk to firefighter (and others) safety, he said.

The software

Underlying everything is a computer game engine called "Unreal Engine" from a US company called EPIC, which is also used to build the popular Fortnite computer game.

EPIC is interested in enterprise users as well as computer game companies. Other customers include pharmaceutical companies using the technology for collaborative drug discovery, providing people with access to models which tell you how to design molecules, and manipulating molecules to create new drugs.

The EPIC technology has also been used by McLaren for car design. "I saw their design director give a demonstration of drawing the curve of the car. It took him 5 minutes – it used to take one designer up to 20 days [on] pencil and paper to achieve the same result. The outcome being a faster design cycle and greater number of new models to market."

What did you enjoy most about the event?

> **Paul Cleverley's talk.**

> **Machine learning applications.**
> *Diwin Amarasinghe (Ex Saudi ARAMCO)*

> **LA12 Ltd (Paul Helm).**

> **The practical papers - this is what we have now to resolve this problem.**
> *(Working Smart)*

> **The diversity of talk topics.**

> **Time out for intellectual thought and discussion. Networking.**

> **Questions and Answers.**

> **Networking.**
> *(Petrafiz Ltd)*

> **A most informative presentation.**

Expert-centric digital technology January 24, 2019, London

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