# Finding Petroleum

Why domain experts need to understand analytics

Why analytics is hard for oil and gas companies

Getting insight from satellite imagery

Making messy file shares manageable

Bringing analytics to unconventionals

Analytics in operational safety

**Solving E&P Problems with Digitisation, London, Nov 20 2017**

Special report

# Solving E&P Problems with Digitisation

November 20 2017, London

**Event sponsored by:**

DigitalGlobe

Hampton

Teradata

Petromall

Finding Petroleum

This is a report from the Finding Petroleum conference "Solving E&P Problems with Digitisation", held in London in November 2017

**Event website**

www.findingpetroleum.com/event/0a27b.aspx

Many of the videos and slides from the event can be downloaded from the event agenda page.

Report written by Karl Jeffery, editor of Digital Energy Journal
jeffery@d-e-j.com
Tel 44 208 150 5292

**Sales manager**
Richard McIntyre
rmcintyre@d-e-j.com
Tel 44 208 150 5291

Event chairman & producer David Bamford

Report author Karl Jeffery

Layout by Laura Jones, Very Vermilion Ltd

**Digital Energy Journal**

www.d-e-j.com

Future Energy Publishing,
39-41 North Road,
London, N7 9DP, UK
www.fuenp.com

digital energy journal

# For E&P to digitise, more people need to understand it

If the oil and gas industry is going to achieve the potential of digitisation, more people need to understand it, said David Bamford of Finding Petroleum

As private individuals, just about all of us now has a smartphone, and we figured out how to use it without any help from our IT departments or consultants, said David Bamford of Finding Petroleum, in his opening remarks to the Nov 20 London forum, "Solving E&P problems with digitisation."

But when it comes to technology in the E&P space, one of the biggest problems is a lack of understanding of what it can do and how to use it.

Mr Bamford said he has experiences of asking technology vendors about their meetings with customers, and asking the vendor, "is there anyone sitting across the table who understands what you are talking about, what you can offer?"

"The answer is typically, well, no", he said.

Perhaps it is useful to recall the introduction of 'exploration' 3D seismic in the oil and gas industry in the early 1990s – where oil companies made sure they knew how to use the technology, sometimes by poaching staff from the technology companies that were developing it.

"It was the presence of these folk that enabled [3D seismic roll-out] to occur successfully," he said.

At the time Mr Bamford was working in the geophysics department of BP, with a geophysics Phd but no geological training. But he learned how to work with 3D seismic data to work out what is happening with a reservoir.

Many oil and gas companies saw a big improvement in exploration success rate by "getting the right information into the hands of the people," he said.

Today, many consultancies and service companies are offering complex technology for the oilfield, but "petrotechnical professionals have very little means in their own organisations of onboarding that technology in the way that I describe for seismic."

"It's even worse in branches like sedimentology, stratigraphy, geochemistry where that layer of expertise has been taken out of companies," he said.

A further point is that to get a new technology absorbed into an oil and gas company, "you have to have a really sharply defined definition of the business problem you're trying to solve," he said.

"I've had a long experience with contractors, seismic companies, consultants and so on, very often there's a feeling that a solution is being provided without clarity about what the business problem being tackled is."

Today, senior management of oil companies recognise that effective use of digitisation is the pathway to being able to survive at $50 a barrel. "There's a significant problem sitting between the declarations that digitisation is going to transform our industry, and enabling us to live at $50 a barrel," he said.


*David Bamford, Petromall Ltd*

# Duncan Irving – filling gaps in decision making

Digitalisation could be described as using digital tools to try to fill in gaps of human understanding, so that people can make better decisions, says Dr Duncan Irving of Teradata

One definition of digitalisation in the E&P space could be trying to fill gaps in people's information and understanding of a situation, so that they can make better decisions, said Dr Duncan Irving, Oil and Gas Practice Partner with Teradata, speaking at the Nov 20 London Finding Petroleum forum, "Solving E&P problems with digitisation."

The basic idea is that the organisation can make better decisions, through better responding to operational, tactical, strategic issues and opportunities, by assimilating and contextualising data.

It can be described as a "very tight coupling between what your organisation captures in terms of data, how it can process it, and decision support around that," he said.

It can be seen as a continuation from other methods to improve decision making and reduce problems for a few decades, such as with the methods from W Edwards Deming, who helped the Japanese automotive industry improve during the 1960s and became something of a hero in the mid-1990s in the US.

It will ultimately enable the CEO of an upstream oil and gas company to respond to challenges with the best decision in the best time frame.

Teradata is a US company with around 12,000 employees, working in banking, retail and telecom industries as well as oil and gas, helping companies to get more value from their data.

In the oil and gas industry, Mr Irving's work can be about explaining what digitalisation can do, what the data science capabilities are, where the failures are, and where expectations from digitalisation need to change, from both clients and technology providers.

### Data silos

One obstruction to the use of analytics in the oil and gas industry is data silos, where data is kept in buckets unconnected with other buckets. Another term for this is "data islands".

Part of the blame for this can be placed on the "point" software packages which oil and gas companies use for specific petrotechnical tasks, such as model the subsurface or simulate reservoirs.

*Dr Duncan Irving, Practice Partner, Oil & Gas of Teredata*

It can be very hard to integrate data from these point software packages with anything else, he said.

The problem is not so bad in other parts of the industry. Oil and gas companies have been integrating sensor data with inventory, asset location and financial systems for a while now, partly under their "digital oilfield" initiatives. Perhaps the growth of "point" software for petrotechnical work was due to limited understanding of the petrotechnical domain by IT staff.

The data silos can work well individually, but the silo-isation means that the overall company is sub-optimal, and there wasn't much standardisation and consistency between departments, he said.

IT departments in other industries have been fixing these sorts of problems for 10-20 years, "but we never got around to that in operational centres of the oil and gas industry," he said.

"Other industries that from a distance look at bit like the oil industry have been doing this quite well for a few years," he said.

For example Siemens is using analytics to monitor performance of its locomotives, and by doing this, achieves very high levels of uptime.

The analytics is used to predict components about to fail, and then use that understanding to improve equipment uptime, and maintenance schedules. There are add-on benefits, for example rail companies work out that they can manage with less locomotives because there are less failures and less need for spares.

Another example is pipeline companies which use analytics to predict hydrogen sulphide build-up, and then use this understanding to better manage pipeline integrity and improve asset management, and getting better flow assurance.

### Why it is hard in oil and gas

Dr Irving listed a number of obstacles which make analytics difficult in the oil and gas industry.

One obstacle is the "project" mentality – staff are used to embarking on short term projects, but less enthusiastic about changing how they work.

Another obstacle is that many people have a siloed view of the industry, seeing mainly their own part of it rather than the overall picture.

Another problem is communications difficulties. IT and data managers are often not very good at understanding business requirements, and business people are not very good at communicating to technology providers what the business does. There is a gulf in vocabulary between technology providers and clients. Concepts like data lake, data governance, meta data and master data are used to mean different things in the oil industry to how they are used in other industries.

Also, the upstream space often does not have data well managed and open enough to be used for analytics.

Sometimes inter-company communications are poor. Dr Irving often finds an oil company can have multiple IT teams doing similar projects and no alignment or integration between them, leading to duplicated effort.

Another obstacle is lack of strategic planning. Sometimes oil companies decide they will make big investments in analytics with millions of dollars over multiple years, but it just ends up with people dabbling in a point project and then moving onto another one, rather than the company improving the way it works.

Individual projects can run over years, which means that when people finally get an analytics tool, it meets their requirements of 3 years ago and might be no longer relevant to their needs.

## Data

The oil and gas industry should make data quality a central focus if digitalisation is going to work, he said.

Organisations need to have consistent standardisation of their data, and quality and governance applied around it, consistently through the company.

If you want to try using machine learning and pattern recognition algorithms on your data, it won't give good results if your data is bad to begin with, he said. This will also mean that any machine learning engineers your company has hired won't be able to do anything, and will probably get bored.

The oil and gas industry could start working with data engineers. Other industries with large amounts of data, such as banking and retail, do this. The data engineers know how to make sure that data is in a format appropriate for the business, and know how to provision data from the point at which it is acquired to the point where it can be used.

It is also helpful to have domain experts (such as petrotechnical professionals) working with data, because they understand factors like how the sea state will affect the data recorded in a seismic survey.

## How other companies do it

A typical set up for improving data in companies outside the oil and gas industry is to have a team working on day in two week bursts, aiming to come up with something useful during this time, or something which opens the door to another stage of the project.

There might be two tiers of data people. On the bottom tier you have people who are managing a data platform, presenting a data interface. On the top tier you have "technical design" specialists who build analytics tools running on the data platform, which might generate something useful to the business, ensuring that the data quality is good enough for it to work.
Their analysed data can then be presented to the industry professionals (such as geophysicists). The whole infrastructure can be part of the permanent corporate data systems.

## Maturity scale

You can describe a maturity scale for digitalisation, so companies can see how well developed they are, Dr Irving said.

The end goal is to reach a maturity level where companies have systems which can answer questions like, "last time the well targets were like this, the drilling options were like this, and I had this sort of engineering capability, what well plan proved to deliver the best outcomes?"

It means having a "feeling of data quality" baked into the organisation's culture, processes and tools.

But too often the oil and gas industry is at a very early stage of digitalisation maturity, with companies struggling to answer a question like "can you give me a list of all the wells in our organisation without duplicates".

Having a list of wells with no duplicates is an essential starting point for integrating data from multiple sources, for example combining the well logs from one data store with the borehole data from another data store.
As a general point, having high quality data means that you can put one type of data in the context of another piece of data, without having to spend a week checking. People can take data they need out of the corporate system as they need it, without questioning whether they can trust it.

"Our key recommendation to our clients at the moment is, you need someone as a directly of quality across all of your upstream data."

## Good enough data

What quality of data is "good enough" depends on the application. For example, you need different levels of numerical and spatial precision depending on whether you are working at a well, basin or overall portfolio scale.

An exploration geologist does not need super-accurate data. The understanding comes from reading a few papers, looking at maps, looking at some wells data, and looking at some 3D seismic, and forming a mental model of what is going on.

But if a company wants to benchmark reservoir performance against each other, spotting underperformers, it will need a great deal of information about the reservoirs in a format the computer can read.
For example, lithology, reservoir properties, production dates, perhaps even political situation of the country. Typically companies do not

have their reservoir data anywhere near good enough for this sort of work, he said.

But when working at a more tactical level, defining well targets and planning wells, working with say 30 different wells and sidetracks, with models from reservoir engineers, and well needs to reach a certain formation, you need an understanding of what is going on "in a few tens of metres". You need to be comfortable that you can trust the data, including data provided from one of the partners in the asset.

When drilling is going on, with efforts being made to keep the drill bit above the oil water contact and below the caprock, every couple of hours you want to check the data from the drill string, in the context of the petrophysical data you already have of the formation, the formation may be only 10m thick.

An example scenario could be to be drilling through rock at an angle, and you have logging sensors on the drilling tool recording data, and you have recorded the distance between the sensors and the drilling rig as a proxy for the depth of the sensor. But because the drilling is at an angle, you need to do some trigonometry to find out the actual vertical depth of the sensor. Otherwise, you might have errors in matching the lithography to the sensor log data.

A further problem could be that you don't record whether or not you have made the correction to convert the position of the sensor on the drillstring to vertical depth – and so someone makes this correction twice.

This illustrates that good data quality is not just about numerical quality, but understanding the metadata around it – how the data was actually recorded and any corrections which have been made.

## Correcting logs

If all of your data is good, you can use machine learning to fill any data gaps.

As an example, demonstrated as part of a geophysics "machine learning hackathon" in Paris in June 2017, a team worked out a way to use machine learning to fill gaps in well logs, based on data from the other logs, and how the log data interacts in other parts of the well.

The quality of the machine generated log could be tested afterwards, by comparing it with the actual log file. "Even if it is not absolutely accurate to the nearest metre, it captures a lot of the structure," he said.

It was done with open source software which was put together in a couple of days, running machine learning on a few wells, and deploying it through a Spotfire dashboard.

## linking the data silos

Mr Irving was asked whether it seemed actually likely that oil companies will link their data together.

"It is more a case of when rather than if and by what degree," he replied. "Certainly in US unconventionals operators most of them are there now.

[But] "I can't see it happening in seismic processing any time soon. We're just not seeing it so much in offshore part of the world - it is so asset heavy and so many participants in it who generate data for their own reasons."

In the offshore sector there can be logistics and supply chain in one room and drilling in another room, and they hardly ever share data.

There is a top down push to link data silos, in that the management consultants like Bain and McKinsey are making presentations to company boards and saying "this is what you are currently doing, you will not be able to do $50 a barrel unless you think like this." But some companies are moving faster than others.

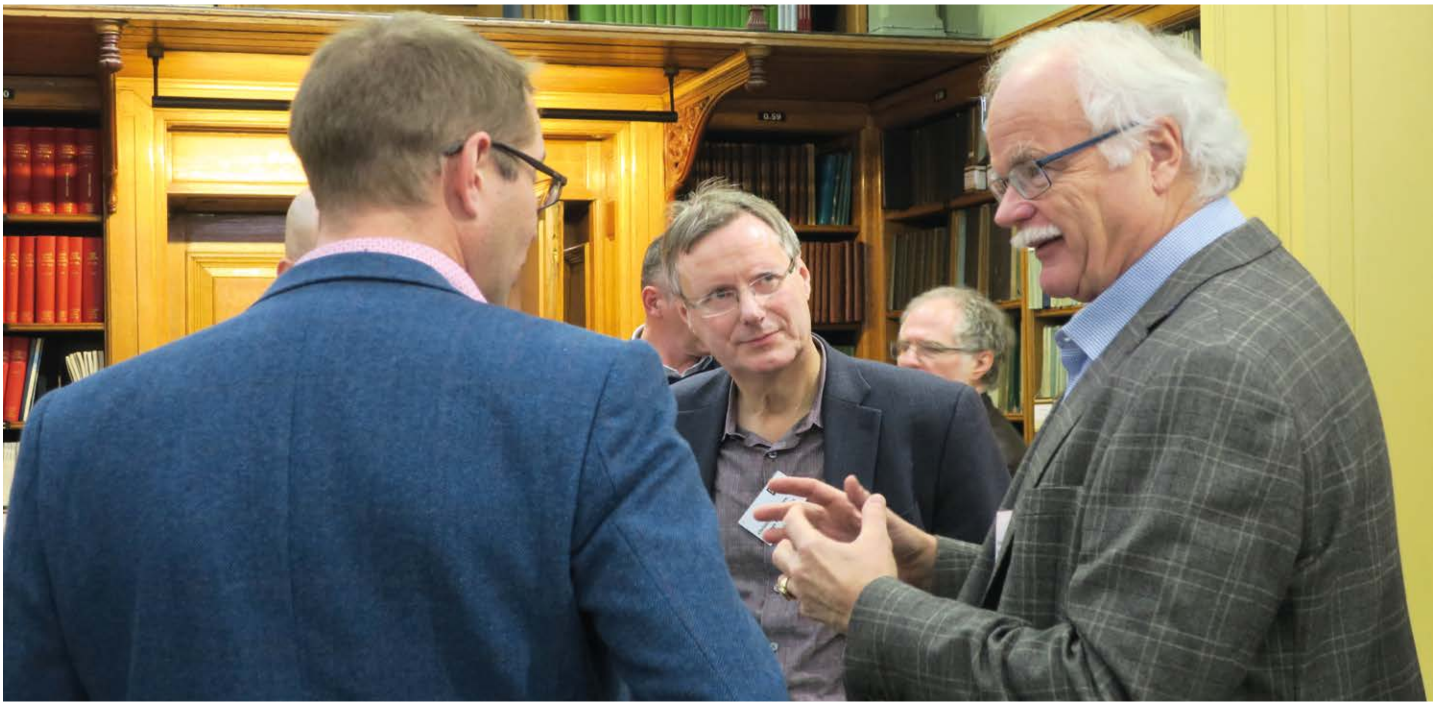
## Integrating all company data

Some companies have tried to integrate all of their company data into a single system, perhaps misunderstanding the 'data lake' concept, and it hasn't gone well, he said.

"If you take a technology into an organisation and it's not ready for it, and you don't understand what you are doing with the technology, you will make a mess," he said.

You have to start with small projects, perhaps with a well understood problem like predictive maintenance, and gradually change culture.

For example Siemens tried to improve reliability of some of its locomotives, rather than try to improve analytics for the whole organisation. Then someone realises that the analysed data can work together with something else.



# DigitalGlobe - insight from satellite imagery at global scales

DigitalGlobe, a provider of high-resolution Earth imagery, data and analysis, is helping oil and gas companies do more with satellite imagery, such as monitor competitors, spot trends and evaluate potential purchases

DigitalGlobe, a provider of high-resolution Earth imagery, data and analysis, is developing analytic capabilities which enable oil and gas companies to do much more with its content, such as monitor what competitors are building, or track how an installation has been modified over time.

For example, one oil company in California used its satellite imagery to detect small changes in ground movement, which could indicate well bores under stress and possible well integrity problems, said Deborah Humphreville, Director Key Accounts EMEAR, DigitalGlobe, speaking at the Finding Petroleum London forum on Nov 20th, "Solving E&P problems with Digitalisation".

The technology has been used to look for oil seeps on the surface, an important component in oil and gas exploration.


*Deborah Humphreville, Director Key Accounts EMEAR, DigitalGlobe*

One company used the technology as part of the decision making process in acquiring a refinery, to see how the refinery had changed over time.

Some companies use satellite images to try to see what competitors are up to, including getting images showing how full storage tanks are.

Computer algorithms detect all the tank farms in a satellite image, and the pipelines connecting them to wells.

It can track the pathway of a competitor's oil, from oil wells, to tank farms, to tankers, and then track the tankers, by adding in vessel tracking data.

One of the highest value areas is in gathering data about change – for example showing where oil companies are building roads, or if the number of cars using a shopping mall car park daily is increasing.

## Data

DigitalGlobe has been collecting the world's highest resolution imagery from space for 17 years.

By doing storing and creating the tools to leverage this information DigitalGlobe has effectively created a digital library which documents every inch of our changing planet.

Today there is data from many different satellites, including free government data, and multiple commercial services. Over the past five years there has been a massive increase in satellite data, due to new satellites being launched.

DigitalGlobe aims to make it as easy as possible to work with the data, with both data and analytics tools available via Amazon Cloud. You can also use DigitalGlobe's data together with your internal corporate data.

Generating business intelligence from satellite imagery takes a few analytics steps.

The company provides an "ecosystem of algorithms," which can be used to run on the data, and generate the "information layers".

For example you could use an image algorithm to spot all the aircraft on a satellite photograph, first training it to understand what an aircraft looks like on a satellite image.

Some companies use their own data scientists, others bring in data consultancies.

## Australia case study

Ms Humphreville presented a case study of using analytics on satellite imagery for the entire country of Australia, for a client who wanted to know about the mix of housing stock in the country, how much of different types of roofing materials are used, how many swimming pools there are and what kind of vegetation there is.

Australia is 7.7m square kilometres, with 24m people and 34m structures.

Taking high resolution satellite imagery of the country, the first layer of analysis was to automatically extract what looked like building footprints, without knowing what the buildings were.

A second step was to analyse the colours of the buildings and land, to develop a land use map, looking for vegetation and farms.

A "roof material extraction" step tried to identify roof material of all the buildings.

The map was reduced to vector components, showing the different buildings and land use as lines rather than a coloured photograph.

The work took a month. The hardest part of the work was building a flow chart which would enable the computer to follow a series of steps to understand the components, she said.

"That's what analytics is all about, object detection, feature extraction, and then generalising it," she said.

## Other examples

The technology has also been used to map populations, including for making plans for broadband connectivity infrastructure or tracking how a disease might be spreading.

Insurance companies used satellite imagery after major disasters, such as flooding in Houston, to try to estimate the scale of damage and where to deploy personnel.

In another example, the satellite imagery was used together with other data to make a model which could predict the wealth of a neighbourhood using satellite imagery.

# Hampton Data – a messy file share to something manageable

Automated tools can help turn a disorganised file sharing system into a system where you can see all the files you need straight away. Wally Jakubowicz of Hampton Data Services explained how to do it

Oil and gas people often find that they have to find the documents from someone else's file store, which may have had some structure at some point, but it isn't clear. And with lots of files having similar content, you can't necessarily find what you need with keyword search. To make the challenge harder, there are probably lots of duplicate files.

Hampton Data Services is developing automated tools which can sort through a data store like this, and present the customer with a much more structured system for accessing the files.

The new file system is 'virtualised', which means that it looks like a normal file and folder system, but the files are actually links to the original files, stored in their original location.

This means that the same file can appear in different locations of the virtualised system, without actually storing two versions of the file.

The service is more typically useful for small companies, which often end up with large amounts of files through acquisitions or work by short term staff members, but don't have the rigid data management processes or data staff which oil majors typically have, he said.

## Reach Energy

An example customer was Reach Energy Bhd of Malaysia, which acquired an asset in Kazakhstan which had seen a number of previous operators, working in different languages, so there was data in English, Russian, Mandarin and Kazakh.

The companies had different cultures and had worked with data in different ways, and used different terminologies.

The data store included many studies with multiple versions of the study stored on the system.

The total data size was 330 GB, with 50,000 files – but half of the data is replicated.

There were many maps without much data about what in the world they referred to, or what co-ordinate reference system was used. There was a great deal of aliasing (giving objects such as wells alternative names), including names in other languages and character sets.

The data was stored in folders. If you take one folder, it does not look very chaotic, but as a whole it looks extremely chaotic, as an aggregation of many different people's work.

Reach Energy had a mobile management team, who wanted to be able to access the document they needed immediately from anywhere in the world.

The company also had staff who wanted to work with multiple documents, such as reservoir staff who wanted to evaluate reservoirs using all available data, such as core data, production, well test, pressures and temperatures.

## UK unconventionals customer

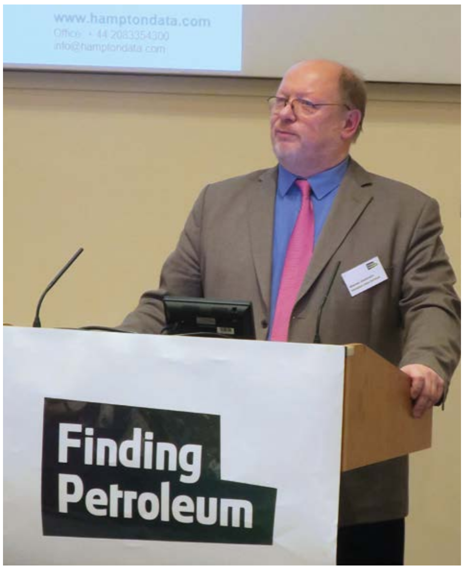
Hampton Data also did a project for a UK onshore unconventional oil and gas company, which was finding that its drilling generated so much data, that staff were swamped in data when the well was only half drilled.

Unconventionals generate much more data than conventionals. Typically, each contractor involved is doing something in their own way – naming wells differently, and saving LWD and wireline logs with different naming systems, Mr Jakubowicz said.

## Problems with folders

It is common for companies end up with many different folder structures, with a variety of personal folders, and folders for different disciplines. Often companies try to impose a disciplined file and folder naming system, but data inevitably ends up all over the place, Mr Jakubowicz said.

Within the folder system, companies try to organise data against different processes – but often they are not always using the same well name. Sometimes people make filenames with long sentences. Sometimes the filename gets so long it hits restrictions, which causes problems moving the file. Then folders planned to be temporary become permanent.




*Waclaw Jakubowicz, Managing Director, Hampton Data Services*

In one example, the name of a well appeared in 281 different well logs and general report files, making it very hard to work out which one you need.

In the oil and gas industry, the data can include seismic traces and curves, scanned well logs, maps, seismic sections, pdf files and other analogue representations of data.

There is also big growth in unstructured data, which now accounts for the majority of data.

## The automated system

The system developed by Hampton can use a range of automated tools to crawl through the files, try to identify what they refer to, and tag them accordingly. These tags can then be used to place the files in virtual folders.

For example, if something on the data appears to reference a certain geographical location, you can tag it to that location, and then link the tags to a geographical information system (GIS). When you have geotagged data, you can then link it to a field or a specific oil well.

The machine can identify what the file is, and if it understands the structure, take data from it – such as extract a single curve from a well log of multiple traces.

The software can flag an inconsistency, for example, the data file has a name saying it refers to one well, but the header content inside says it refers to another one. In this case a person has to intervene.

A duplicate scanning system can identify if the content of two files is the same, even if the filename is different.

Metadata can be added automatically, from extracting phrases from the introduction to documents, or saying what data type it is. You can also add in data manually at this stage.

You need to use many different software applications to work with it, including optical character recognition (OCR) tools for documents not stored in text format.

The system is not entirely automated – people also monitor how the file crawling and indexing is going, and if necessary create a new rule to improve the system.

## Final product

The final product, also looks like a file share, but with data much better organised and labelled than in the original.

The customer can decide how they want data from each field to be presented, for example with different folders for production data, downhole pressure tests, and other sensor data, seismic data and observers' reports. Or you can click on a folder for the well and see all the documents related to that well.

The index can be provided as a cloud service, where you click on a filename and it will open a file from your internal corporate server.

You can also search for data 'intelligently', for example look for log plots with a specific start date, or plots with a certain sort of curve, because the automated system can pull this out of the well log file.

You could call it an "autonomous virtual data custodian."

The system doesn't run entirely automatically, it needs some human "looking after". But "that's a relatively small intervention compared to how many man hours are needed to do it manually," he said.

Sometimes country regulations dictate that data cannot be moved outside the country – but in this case the metadata from files can be moved out of country and stored in your central system. The metadata can be used for a lot of analytics.

If any new data arrives, it can be automatically classified as the files are put in the storage system. The user just "drops and forgets".
In theory, customers (geoscientists) can "drop and forget" their files anywhere on the file system and the computer system will tidy it up.

This ability might appeal to many explorers, who often don't like being told how to organise their files, one audience member said. They can leave their files wherever they like and they are still easy for someone else to find.

There is no limit to the scale – the technology has already been applied on a UK continental shelf database covering 12,500 wells and 150,000 reports.

Machine learning, where the computers learn themselves, could one day analyse the content itself. It "is somewhat embryonic but shows a lot of hope," he said.

# OAG Analytics – bringing analytics to unconventionals

Oil and Gas Analytics of Texas is helping US onshore unconventional companies make use of analytics to optimise what they are doing – and overcome some of the challenges

Oil and Gas Analytics of The Woodlands, Texas, is helping US onshore unconventional oil and gas companies make use of analytics to optimise what they are doing – and overcome some of the challenges in doing it.

It has customers working in the Barnett, Bakken and Permian basins.

Good decision making is critical for small operators – deciding which basin to focus on, finding the 'sweet spot' in that basin, working out where in the horizon to drill, and coming up with the right well design. One dry well can put a small company out of business. "So it brings a certain focus to posing of questions," said David Bamford, who is currently serving as interim chairman of the company.

To indicate how critical it is to find the 'sweet spot' in a basin, "If you are inside the sweet spot you will make money at $30 never mind $50. If you are outside it you struggle at $100," he said.

US onshore companies can typically have 5,000 to 10,000 wells within the company, so an enormous amount of data to analyse.

## Most important parameters

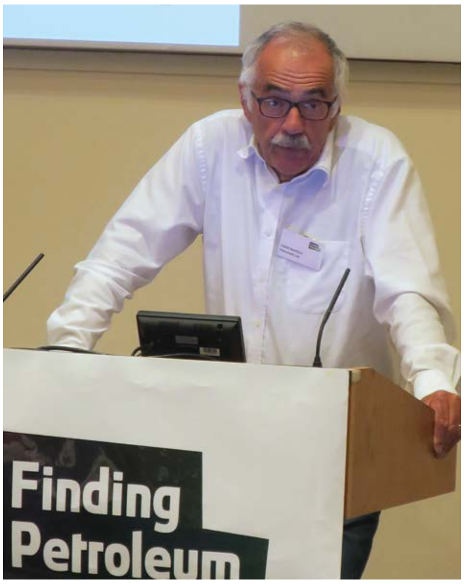
One of the most useful analytics services is working out which, out of all of your pieces of data, has the biggest impact on the overall performance of the well.

To do this, OAG can do a "multivariate analysis," analysing how each parameter varies with every other one, to see which appear to be most important.

Cloud computing services are very helpful for this, because they can provide a large amount of computing power to you for a short period of time, without having to purchase computers yourself.

Some well systems have 150 different parameters which could be provided.

There would be a page of geological information about the reservoir, including rock porosity, permeability, geochemistry, brittleness.



*David Bamford, Petromall Ltd also currently serving as interim chairman of OAG Analytics*

There will be data about the well physical properties such as where it is, what it is doing, what kind of production it has, what the completion looks like.

You could have that data for each thousands of wells.

The computer can work out how much the parameters relate to each other, if at all.

The results can be visualised by showing all the different parameters around a circle, and a line connecting together parameters which seem to be related. If a parameter has a thicker line going to it, it indicates that it relates to many other parameters, and so that parameter is more important.

Conversely, the engineer can see that some of the other parameters are not important at all, and they can probably be discarded from further analysis.

If the analysis is looking just a production over the first 30 days of the well's life, it could show that there are say just five parameters which are very important to the overall production, such as rock brittleness or choice of completion design.

So this process is both ranking and excluding parameters. Now, when you hear a driller say something like "it is just a manufacturing process, the rocks [properties] don't matter", you have the data to show whether that statement is correct.

Before you can do the multi-variate analysis, you need to organise the data, with a complete package of data for each well. This can take up 75 per cent of the total effort of the analytics project.

Some of the wells might have been drilled decades ago, so the data is available on paper reports made by manual typewriter.

## Domain experts doing the work

The most important part of the analytics work, trying to answer the business questions, should be done by the actual domain experts (the oil company drillers and engineers), rather than the data scientists, because they know what they are trying to achieve, and they have a sense of whether the information provided by the analytics system is useful.

For example, if the multivariate analysis shows that the most critical parameters in a frac are the production in the first 30 days, and the frac fluid used per unit well length, the next stage could be to bring out data showing the trend – how much using additional frac fluid will lead to more production, if other parameters are constant.

Or you could see how production after half a year varies with the length of lateral, with all other parameters kept constant.

Or you could use the system to make a prediction about how much a planned well will produce, taking the planned approach to completion and fraccing into consideration.

The analytics system cannot just throw results out like a black box. The engineers need to understand how it is generating the results.

This is important in making a judgement about whether the results are useful or credible.

Sometimes computer results can be misleading, for example when the analytics seems to show a trend, but on closer look, you see that the predictions on one end of the curve are made on the basis of hardly any data points, and perhaps reject those predictions accordingly. Or an expert might note that the system is giving a reasonably good prediction within a certain range, but not beyond that.

The computer system might show that the higher the water cut, the lower the oil production – which an expert would understand is an expected outcome (with water displacing oil in the production tubing), rather than providing any useful insight in itself.

"The machine is giving you all this information but the user is being put in a position of judging the result, and changing the model, changing the data that's used, changing the emphasis of data, throwing parameters out as unimportant, and so on," Mr Bamford said.

"It seems to be a beneficial approach to put the technology into the hands of the people who actually use it and actually understand what the problem is that they're trying to solve," he said.

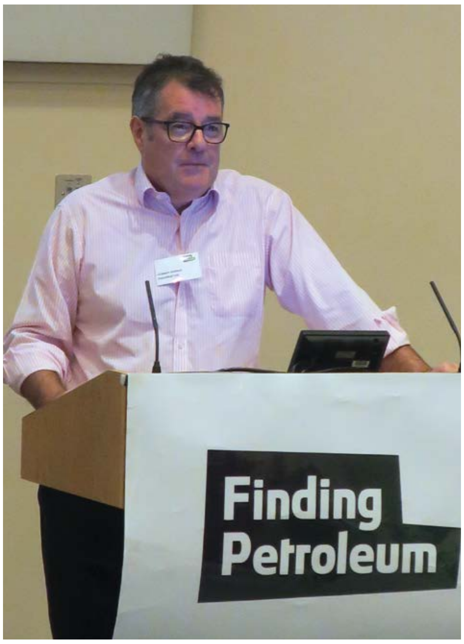
"It seems not to work, again from our observation, if we as a technology supplier try and solve the problem and consult it into an oil and gas company. What goes on must be controlled by the petrotech professional."

For petrotech professionals to be able to work with the system easily, data visualisations are very important, because they are much easier to work with than a stream of data.

# Spotting small problems - analytics in operational safety

One way to use analytics for oil and gas safety is to spot small problems and fix them before they become large, said Graham Scotton of Petromall

One way to use analytics to improve operational safety is to spot small problems and fix them, before they become large ones, said Graham Scotton of consultancy Petromall, a former COO of Dana Petroleum, who has also worked in senior roles with BG and BP.




*Graham Scotton, , Petromall*

Mr Scotton presented a software tool called "Digital Risk Analyser," produced by a US company check called Near Miss Management. The companby's leadership team includes a specialist in industrial near misses, a specialist in data based risk analysis of large processing plants, and a former VP group safety with BP.

The software analyses the streams of data generated by modern process plant, aims to spot potential problems emerging, and presenting them to the engineers for further investigation.

It can take data from multiple sources, such as the data historians, the digital control system check (DCS), the SCADA system and sensor networks.

The software system is separate to the system for running the process plant.

It does not aim to identify major problems itself, but aims to be a component in the daily routine of the professionals working with the equipment and trying to determine priorities.

## A near-miss on a gas line

To illustrate the potential value of the software, Mr Scotton told a story of one of his own experiences where there was nearly loss of life, and which could have been prevented with better use of data.

There was a gas line leading to a flare, and there was more moisture than usual in the gas line. This meant that the gas combined with water to form (solid) hydrates, and plugged the gas line, sending gas back down the pipe to the process equipment, where people were working. Luckily there was no ignition source. If there had been, there might have been a large loss of life, he said.

There was a pressure sensor in the gas line, which was meant to detect this sort of problem, sounding an alarm if the pressure increased above a normal working range, perhaps due to a blockage emerging. But the sensor was not wired into the main control system.

If there had been a more sophisticated software monitoring system, it could have warned the operators that there were excessive amounts of liquid in the gas line, or that the pressure sensor was not working.

There would have been data available which could have enabled this to be determined, but like most oil equipment data, is not monitored very much. People are not able to interpret it all, and the software systems are not sophisticated enough.

## Oil and analytics

Mr Scotton is a keen observer of how oil companies typically work with analytics, and where the weaknesses are.

Oil companies spend lots of money at the capex stage putting in all kinds of sensors, but very little of the data from it ends up in front of anyone, who might have the ability to say, there's something about to go wrong here.

The oil and gas industry is more comfortable doing things by trial and error, or in other words, it should work today because it worked yesterday.

People who fixed problems after they happened can get treated as heroes in the company, but people who spot problems before they happen and prevent them don't get the same recognition. So there isn't much incentive to identify and fix small problems before they grow, he said.

The standard way of working for production engineers is to have morning meetings, where people sit around a table and try to solve problems which have already happened.

Many times he has seen analytics systems provide useful advice, but then it is overridden by people's opinions, he said.

Meanwhile the industry is seeing exponential increases in data volume, variety and velocity. "The capacity to deal with it has to increase as well."

There are plenty of industries which are a lot better than oil and gas at analytics, such as the airline industry, generating data constantly about the condition of its aircraft. "We've got to look at all the technologies, we've got to connect all the component parts, to allow us to be able to see an asset in a whole new way."

# Solving E&P Problems with Digitisation , November 20 2017, London, Attendees

Tom Fox, Director, 1234most Ltd - dynamicforecaster.com

Allan Induni, Geoscientist

Hugh Ebbutt, Director, A T Kearney

Christian Bukovics, Partner, Adamant Ventures

Paul Murphy, Key Account Manager, Oil and Gas Division, Airbus Defence and Space

Alexander Estrin, , Alesther Ltd.

Geoffrey Boyd, Field Development Consultant, Antium FRONTFIELD

Maria Mackey, Energy Sector, AWS

Simon Berkeley, Director, Berkeley Associates

Patrick Randell, Geologist, BP Exploration

Nick Pillar, Manager of Geophysics, Canadian Overseas Petroleum Ltd

Micky Allen, Consultant

Diwin Amarasinghe, Geophysical Specialist, Consultant

Richard Walker, Consultant Geophysicist

Dan Kunkle, Director, Count Geophysics

Christopher Frost, Lead Technical Analyst, DataCo

Deborah Humphreville, Director Key Accounts EMEAR, DigitalGlobe

Toya Latham, Drilling Info

Darren Jones, Data Analyst/Cartographer, DrillingInfo

Stephanie Warne, Data Manager, DrillingInfo

Terry Price, Managing Director, Easymatics

Nnamdi Anyadike, London office, Energy Correspondent

Boff Anderson, Snr. Land Operations Manager, EPI Group

Ricky Schuleman, Web Developer, Evaluate Energy

Funmi Akinfenwa, Data Manager, ExxonMobil

Amber Harding, IT Manager, ExxonMobil

Malcolm Humble, Upstream Data Coordinator, ExxonMobil Global Service Company

Richard McIntyre, Sales Manager, Finding Petroleum

Karl Jeffery, Editor, Finding Petroleum

Avinga Pallangyo, Conference Organiser, Finding Petroleum

John Leggate, Managing Partner, Flamant Technologies

Irina Awote, GBC Ltd

Thomas O'Toole, R&D Geophysicist, Halliburton

Ben Saunders, Product Manager - Analytics, Halliburton Landmark

Waclaw Jakubowicz, Managing Director, Hampton Data Services

Lawrence Jackson, Senior Account Executive, IHS

Martin Merryweather, Managing Director, Independent

Manouchehr Takin, Independent Consultant

Greg Coleman, CEO, Independent Resources Plc

Jonathan Baker, CEo, InnovationCo

Mark Jones, Business Development Manager E&A, INTECSEA

Simon Kendall, CEO, Interica

Duncan McLachlan, Digital and Innovation Lead, io Oil & Gas

John Griffith, Upstream Advisor, JJG Consulting International Ltd

Peter Allen, Consultant, Layla Resources

Morten Lindback, Analyst, Lindback Energy

Neville Hall, Director/Consultant, Llahven Ltd

Anne-Mette Cheese, Exploration Geologist, Lukoil Engineering, London Branch

Rupert Simcox, Data Analyst, Lynx Information Systems

Mark Ashford, Managing Director, MACOM Consulting Ltd

Christoph Ramshorn, Director, Manage Your Options

Jonathan Jenkins, Director, NDB Upstream

Mike King, Oil & Gas Manager, NPA Satellite Mapping

Brendan Kelly, Managing Director EMEA, NRX AssetHub (HubHead Corp)

Abi Mirkhani, COO, OPG Supply

Graham Scotton, Petromall

David Bamford, Petromall Ltd

Henry Dodwell, Consultant, PetroVannin

Frederic Yeterian, Director, Philax International (UK) Ltd

Robert Snashall, Consultant, RGSConsult

Andreas Exarheas, Assistant Editor, Rigzone

Mike Larsen, Business Development Director, EAME, RPS Energy

Brigitta van Niel, Technical support Manager, Sasol

Caleb Dadson, Sasol Petroleum

Robert Heath, Marketing Manager, Seismic & Oilfield Services Ltd

Michael Dyson, Manager, Striatum

Filipe Mota da Silva, Head Solutions, Tata Consultancy

Duncan Irving, Practice Partner, Oil & Gas, Teradata

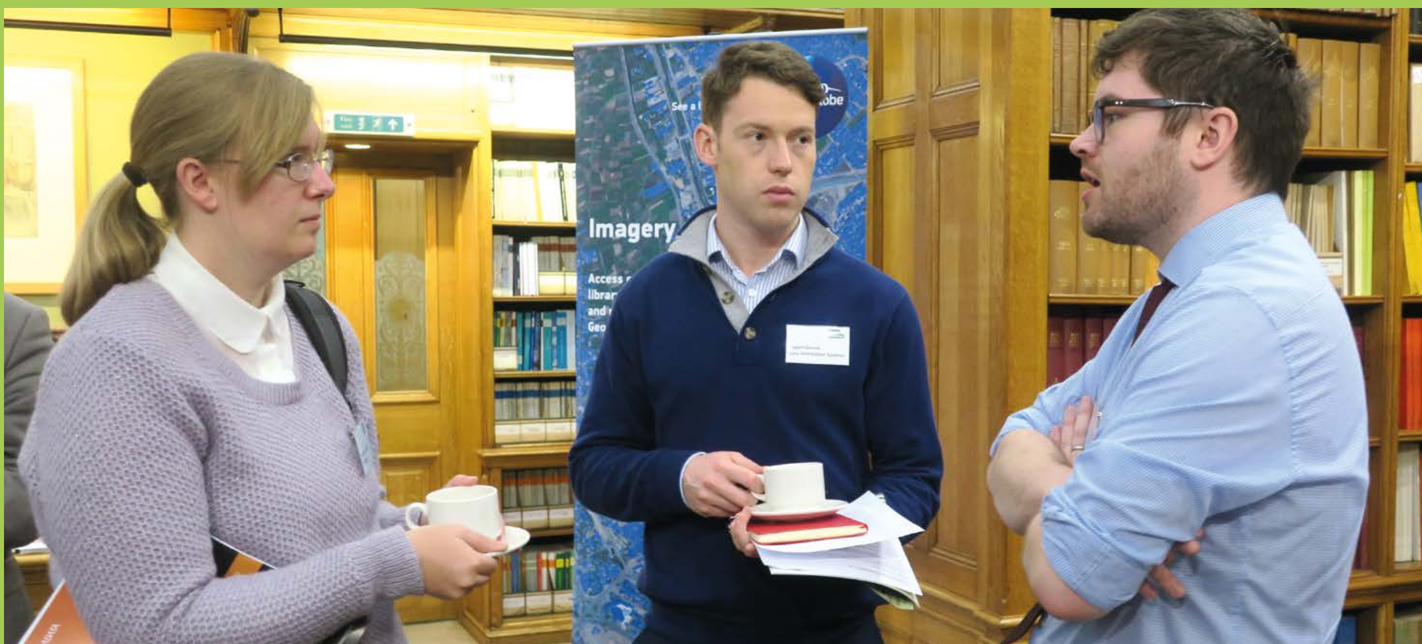
Peter Roberts, Business Development Manager, Tessella

David Gamboa, Associate, Integrateds and Upstream Research, Tudor, Pickering, Holt & Co.

Ian Jones, Head of IIS Practice, Venture Information Management

Pete Floyd, Senior Manager Upstream, Wipro

Kebir Tafferant, Data Associate, Wood Mackenzie



# What did you enjoy most about the event?

> Networking and stimulating talks.
>
> *JJ NDB*
> *Jonathan Jenkins (NDB Upstream)*

> Wally's presentation was the most relevant to us consultants / small companies.

> Discussion points, presentations, networking, lunch.
>
> *Mike Dyson (Striatum)*

> Fascinating presentation by DigitalGlobe on satellite imaging and usage.
>
> *Richard Walker (Consultant Geophysicist)*

> The Q&A after each talk, thought-provoking challenging questions

> D Bamford's questioning of - digitalisation.

> Meeting others with similar interests.

> The location and the candid approach.

> Interesting mix, and talks, good networking with ex colleagues in the industry.

> A good turnout.

> Networking with relevant people.

> Teradata Presentation.
>
> *(Finding Petroleum)*

> Networking, Industry Trends

> Questions and Answers