Oil & Gas iQ

OIL & GAS IQ: HPHT DRILLING

HPHT: Terminator, Google & What's Right About Getting It Wrong

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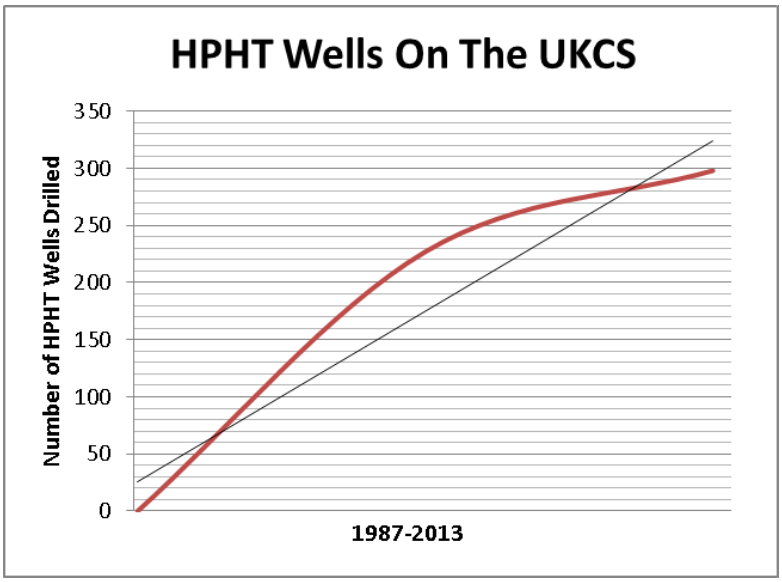
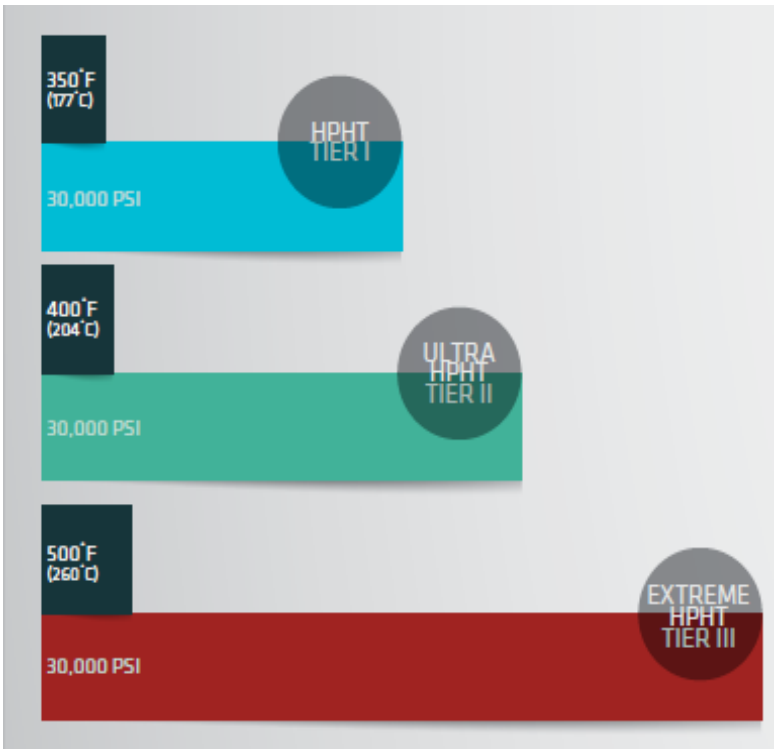
AN OIL & GAS IQ REPORT

THE FACTS

From 1987 to 2013, almost 300 high pressure high temperature (HPHT) wells were drilled on the UK Continental Shelf.



Organised into three categories, these wells not only represent the pioneering forefront of endeavour in today's oil and gas industry, but also the direction in which the sector is being funnelled in an age where commercial oil discoveries are increasingly harder to come by.



As HPHT wells become more prevalent throughout the global oil and gas landscape, technology is becoming ever more important in the drive to master the most inhospitable conditions the Earth's crust has to offer.

In this piece, we speak with a drilling engineer working in east Malaysia and a lead geologist in the Caribbean Sea arena about the novel techniques driving HPHT and why it is important to share failure with your peers.

Haravinthan Arumugam, Engineer & Research Team Talisman Energy

Hara, thank you for joining us today. Please could you tell us a little bit more about what you are specialising on in Talisman at the moment – which is quite a novel approach to the business of drilling.

Not a problem, Tim. I've been in this role for the past six years and we have recently moved into something very new for us, namely the use of synthetic logs for pre-drill using AI algorithms. We have mainly been employing this in our east Malaysia operations, offshore Sabah, and we are getting some very encouraging results.

So, AI for a lot of people is going to mean Terminator and algorithms means Google. Explain it a little bit more for us - what you mean by the utilisation of this in an HPHT context?

Now, this is going to be new for a lot of people, especially those who have been drilling for 20-30 years. It's a bit of a challenge to deliver this talk to a room full of your peers – especially the bit that touches on AI algorithms. The old timers are not easily convinced but then, that is understandable as it is still a frontier technology.

Basically as an operator-side company, we need a lot of data to do our jobs properly - we need as much information *before* we drill a well as we do during and after the drilling process is completed. Knowledge is vital for us, especially in wildcat wells when you don't have really much data from neighbouring wells.

Data volume becomes like a Book of God, you know.

So, whenever at all possible, we want to increase the density of data to boost our planning.

So, before drilling begins, we need to create a robust earth model that incorporates all the existing data we can call upon.

That means everything from the results of seismic surveys to 3D interpretations to workflows for volumetrics and uncertainty analyses. This will form the base of our drilling.

So, once the pre-drilling model is complete, we can use the AI algorithms to extract synthetic logs from the model along the well trajectory, that will help us visualise the response that might be expected.

Of course, simulation software runs on algorithms in any case, but they don't often classify what type of algorithms. AI is just a new adaptation of the philosophy, that's all.

There's an interesting statistic from Jay Pryor, Vice President of Business Development at Chevron, who said that a large offshore field will generate over ten gigabytes of data per day. How are you managing to deal with that data load?

Well, that's true. There is a lot of data out there, but the thing is, how useful is that data? Most data is like a bad patch on a graph, you know? A lot of it won't really show you that much is going on. Wherever possible, we try to crunch as much information as we can and come up with good, reliable data from it.

In that context, AI is a problem solver, it's a troubleshooting tool that can be used like any other simulation software that's around to give you the best possible vision of your operations.

I'm not a sales guys here, so I'm not trying to preach about AI, but it worked for us and it's technology that can be implemented - so why not we share it with the world? If it's useful, might as well be using it.

Teresa Polo, Operations Geologist, LAM Exploration Caribbean Region, Repsol

Teresa, thank you very much for joining us today. You have a very interesting case study for us, about Repsol's experience in a well you drilled offshore Guyana. Please tell us a bit more.

Okay, I'm the team leader of geological operations for Repsol's Caribbean region. I am based in Houston but manage operations in countries like Guyana, Colombia, Trinidad etc. The case study you are referring to is on the Jaguar-1 well which was a wildcat well drilled in Guyana in 2012.

When we started operations I was based in Guyana taking care of all the information evaluation, the well control operations and dealing with the drillers. We drilled Jaguar-1 but we couldn't reach the expected drilling depth of the well which was expected to be 21,435 feet (6.53 kilometres).

The main reason why we couldn't reach it was because we had an unexpectedly high pore pressure. We have tried to identify why we failed to predict such a high pore pressure and why we obviously abandoned the well earlier than expected.

And why was that?

It was for safety reasons. We had the well under control. We didn't have any influx on the well but it was obvious that the well design was not appropriate to continue with the kind of pore pressure that we were seeing.

A lot of people are not so honest about failure. Why be so honest?

Why? Because we already failed.

We almost reached drilling depth, we almost did something, but we failed. We didn't reach the top reservoir and this is one of the things that we need to learn from. What I'm very proud of is that we did everything safely, in a very safe way. We managed to control a well as and observed what was happening with it and this is the major lesson learned.

I don't care that we didn't reach the reservoir or the drilling depth. We have learned a lot from this experience and now we know what we can do for success in the next well.

And why did you fail?

We failed because we didn't contemplate the challenges of a wildcat well and we didn't contemplate the chemical compaction. We couldn't see the chemical compaction in our pore pressure prediction, so this is one of the major lessons learned that we have. It was difficult to see, so with this problem in the mix the well design was completely not suitable for what we found down there.

We also learned that drillers need to have more options for contingencies for the well. The pore pressure did not contemplate the worst case scenario because it was the first well in the area that was drilled into the Middle Cretaceous.

How have you taken what you've learned from this forward into other HPHT drilling operations that you're currently doing?

Many of the things we have learned are related to the tools and operations but others were to do with well control operations - how we controlled the well, how we understood the well's behaviour, and how we understood how to work with this high pore pressure.

From our failure, the success of this well is how we managed to keep the well under control and our communication. Our communication, especially with the drillers, with the partners that were also involved in the decisions and how we managed all the information to try to identify what is happening and actually stopping the well.

Do you think you were more focused on safety because of what happened in the Gulf of Mexico in 2010?

For sure. Anytime that we talk about HPHT or about any kind of problems in our wells we always talk about Macondo and this is one of the reasons that any time that we drill, everything that we see in the well we relate to Macondo.

We try to have the equipment on board to try to identify and do things in a way that will avoid a second Macondo.

What is your advice to those people about applying your lessons to their HPHT projects?

I would say, always go for the higher technology, it doesn't matter how much it costs, or how long you spend setting things up – just go for the highest level technology that you can have at the rig site.

This is something that I'm very proud because whatever we needed to do in the well we did it to understand and we mobilised whatever we needed to have the well control operation in place and to have all the information evaluation in place; this is one of my lessons learned.

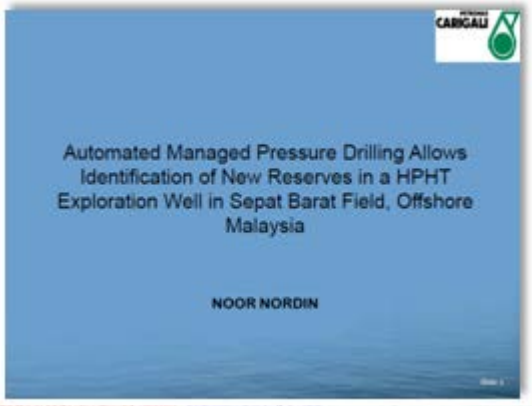
And, obviously, to come to these kind of conferences that you see any other lessons learned that are happening in the different areas.

So, this is also helping to understand each other. Now, we talk about Macondo because it was in the news but there are some other wells that they didn't finish like the Macondo but we can see here because they finished well or they failed to reach DD but they were in a safety way to do it.

So, for me, one of the lessons learned is go with the technology, try to understand what is happening in the different wells and, obviously, a good preparation for the well operations and for the well drilling operations.

Click on the presentation to find out how **ENCANA**:

- Overcame technical challenges associated with production predictions and fracture modelling
- Improved directional drilling tool reliability for HPHT horizontal wells in the Haynesville shale
- Assessed their equipment and proppant experimentation undertaken in extending their current HPHT capabilities



Click on the presentation to find out how **PETRONAS**:

- Maintained an overbalanced wellbore and controlled wellbore dynamics in their Seplat Barat field
- Installed and operated an MPD system
- Evaluated pore pressure evaluation in avoiding wellbore kicks
- Trained, planned and assessed risk to ensure success of HPHT operations

Laurie Scott,
Drilling and Wells Superintendent
Wintershall Norge AS

Laurie, many thanks for joining us today. First of all give us a bit of an insight into your HPHT operations and what stage you're at now.

We drilled our well last summer with the Transocean Arctic. It's a well called Mjøsa and that took about 90 days and that's been a reasonable success for us. And at the moment just now we're building up to drill a second HPHT exploration well at the same rig called the Imsa. The earliest we're going to start that is the middle of December this year.

This is the first HPHT well that you've drilled. What do you think were the keys to making this work?

I think the biggest part of it was when we signed the rig contract we made sure that we chose a rig that we knew could do the job. We had a very open and clear dialogue with the rig contractor. There was some work that needed to be done to bring the rig up to spec and we had a very clear dialogue as who was responsible for what and the timescale to get it done. And we were able to do all that so that it wasn't a focus point when we actually started the operations, so we could concentrate on well construction instead of getting the rig ready and last minute things. That was a massive thing.

The other big thing was we worked very hard on the culture. We created an open and inclusive culture. Nothing's ever perfect, but we spent a lot of time with the onshore and offshore leadership to make sure that we all had the same ground rules when we worked together, all the good work that we did together.

Presumably you need to foster the right kind of environment for that to be happening. How did you go about doing that? What's your approach to that communication and man management?

It's a lot of different things. We're dealing with a big variety of people here and we're all different ages, we're all different experiences. We have to create an open environment where they all feel comfortable to talk about things that they might not be comfortable talking about, things maybe they don't fully understand; things that are difficult to talk about. We spent a lot of time making sure that we could have the difficult conversations as early as possible and get the hard things out on the table and then talk about them constructively and openly. We managed to do it quite easily and quite quickly together. We are constructive when we work together. It's not a, them-and-us, it's a group discussion.

There's a big difference between a top-down management system and a group of peers. A lot of people won't have been in that kind of environment before. They would have expected some kind of autocracy.

The key is that all the third-party contractors, they were the experts. They were subcontracted by us because they are the best at what they do and we were very clear when we constructed the contracts.

There was a high focus on the technical side of it and we tried to repeat that all the time; that they're part of the plan we put together. They own their input into the plan. It's their recommendations that count. We'll make the decisions on what we're actually going to do at the end, but we're very reliant on them giving us their expertise when we built it.

And hopefully when we do that together, because we do that quite early when we freeze the concepts for how we're going to do things, especially HPHT work, then we're in a situation that everybody has an ownership into the end product already.

And we worked hard on not changing people out; making sure they had the same coordinators onshore and hopefully the same people offshore. It means that we end up with people who when they deliver the wells they own what they're doing and they have a passion for their part in it.

Pioneering Techniques And Technology In HPHT Drilling And Completions

Now in its 10th year, the HPHT Wells Summit will showcase international case studies, including the techniques and strategies that have been successful for operators around the world, while identifying the key opportunities for improvement through pioneering technologies.

Highlights include:

- Technical case studies from international operators, analysing how they have successfully overcome crucial obstacles to drilling and completions
- Learn from Pioneering Activities: Which technologies and solutions have worked well, and what areas require further development
- Key industry case studies on technical innovation, compliance and regulatory standards which could help your company reduce risk and effectively maintain well control in extreme environments
- How operators are managing the skill gap and the anticipated impact of the Great Crew Change

Join our expert speakers such as:

John Watters, Chief Well Engineer, **Sasol Petroleum International**
Douglas Forbes, Wells Delivery Manager, **Dong Energy**
Ludovic Mohr, Lead Drilling Engineer, **Maersk Oil**
Nigel Thorn, Well Engineering Manager, **BG Group**
Richard Milton-Worssell, Senior Geoscientist – Exploration, DECC
Elin Skurtveit, Geologist, **Norwegian Geotechnical Institute**

For more information and to download the agenda, visit www.hphtwells.com, email enquire@iqpc.co.uk or call +44 (0)20 7036 1300.

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