Looking into the future with

David Payne, Chevron

By Jerry Greenberg, contributing editor

DAVID PAYNE IS vice president of global drilling and completions for **Chevron**.

DC: Looking into the future to the business of exploiting mature fields and basins, HPHT wells as the industry drills deeper, what technologies or technology advancements do you expect to see in downhole drilling and completion technologies in the next 5 years, and how would drilling rig advancements fit into that picture?

David Payne

PAYNE: I think there is a broad range of technologies, and which technologies will have an impact depends on your location or the technology. From a broad brush perspective, managed pressure drilling in all of its different forms has a lot of possibilities. I don't think anybody can give you a clear definition consistently across the industry what they think managed pressure drilling really is.

I think finding ways to get more hole sections by using unique ways to keep wells under control is going to be a big step for the industry. It is going to have a big impact in deepwater where we have fracture gradients that come close to pore pressure. It will also have applications in some of the deep HPHT work as well.

We have to get better tools for understanding what returns look like. When we are taking kicks, we have to be able to identify things that are happening downhole much better than we can with conventional technologies.

Some technologies are probably not obvious, such as improving flow detection systems. Understanding real-time actual formation pressure would be a huge step. We have a lot of pressure tools from which we can get downhole information, but I don't think there is anything right now that can say exactly what the pore pressure is when you are drilling through it.

Obviously expandable tubulars is a technology we need in order to get pipe into the ground without having to drill big holes. The best way to reduce a well's cost is to reduce the hole size. There is a lot of money to be made by being able to get to 25,000 or 30,000 ft without having to start with big pipe and drilling a big hole. Finding ways to drill smaller holes beginning at the surface is important.

DC: As far as solid expandable tubulars, how far away do you think the industry is from achieving a true monobore well, and is that something the industry really needs or wants?

PAYNE: A true monobore well is the Holy Grail, but you need to be careful what you wish for because you might get it. I am not sure that is ever going to be an approach used on a consistent basis. I think we are going to get somewhere close, but there is a point at which it is not worth going further. There are a lot of people who want to drill true monobore wells in one string, one hole size all the way down. Someone will do it just to say they did it. But I don't see that ever being used extensively because I think you get to a point of diminishing returns and unacceptable risk. We will get close, and I think we are going to get close fairly soon. I think the big step on expandable tubulars is finding ways to make it much more dependable and much easier to install.

If you could drill with expandable tubulars, that would really be a big step change. We still have significant opportunity in casing drilling, but if we find a way to combine expandables and casing drilling, we would truly have developed a step change.

DC: A lot of people are looking at monobores, but you say be careful what you wish because you may get it. What would be the disadvantages to a true monobore well?

PAYNE: If you look at your risk profile and your exposure, there is a reason why you need to have more than one string of pipe at the top of the hole. That is where your big exposure is to environmental damage. We haven't yet gotten to the point where we can put a well in the ground and guarantee that it's never going to have a failure. If you really do run a true single string casing all the way to bottom and you have a leak near the top, you can potentially be in a situation where you wish you wouldn't have done that. When you look at the risks, the technology will be there, but the question is, is that something you really want to do?

Expandable casing is a good tool to have. However, the technology is still not at a level where it can consistently replace conventional casing.

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DC: Where will MWD and LWD advances fit in when looking at difficult or mature reservoirs in the future?

PAYNE: With measurement while drilling, the big drawback is how much data you can transmit. If we can transmit more data from downhole, it opens up a lot of opportunities. Pumping information on pressure pulse very much limits how much data you can send up the hole. You can put a lot more data through an electrical line than you can up a mud pulse. So finding better ways to transmit data would be a significant improvement.

Right now, we can measure more downhole than we can send to the surface in a timely manner. There are a lot of cases where we have to slow our drilling rate to get the data we need. If you can make a one magnitude increase in the rate of data transmission, it opens up a lot of

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opportunities for other real-time measurements downhole. It is not uncommon for people to put a pressure-while-drilling tool in the hole and not transmit that data to the surface in real-time because they are more concerned about their log data from the LWD. Or they decide that the pressure data is more important to the drilling operations, so they store some of the log data. But then you can't transmit the vibration data from the BHA because there is not enough room in the data string. We can pack an incredible amount of data downhole but we need to get more of it real-time to be of value.

DC: Only 10% to 15% of wells have utilized rotary steerable systems, but some in the industry anticipate that figure to increase to as much as 40% to 50% over the next 2 years. What is your take?

PAYNE: In this oil price environment, that is probably right. If the oil price drops, there will be some back sliding due to cost. Also, some tools on the market are so complicated that they don't have the same reliability as conventional tools, which adds to the total cost. So when you improve your reliability you can lower the overall cost of rotary steerable systems.

A couple of rotary steerable companies are working on unique applications for mechanical rotary steerables that are not as complicated as some of the originals. I think that will come.

DC: Do you think if rotary steerables become "simple" and cheap enough that operators would use the technology most of the time whether they need it for a particular well?

PAYNE: There are very few applications where you can say you have to have a rotary steerable. There are some areas where you just can't slide. You have to be able to rotate the pipe to be able to get the pipe to move downhole. That obviously is an application for rotary steerable. But I think that it will start to become more efficient from a total cost perspective and only then will the technology truly take off.

Another piece of technology people don't talk about much but where advances are being made is subsurface description, which is critical. If you look at some of the really tough HPHT wells, a lot of the reasons they are so difficult is not because the actual conditions are difficult but because we didn't know what the conditions were downhole until we reached them. We are not able to do the engineering work and the design work and narrow the range of possibilities of what might happen to be efficient because we don't have a clear subsurface description. Some of the things in

the seismic industry — being able to get a better handle on pore pressure, fluids, rock types and such — those advances go a long way towards making drilling more efficient.

DC: That can go in hand with LWD and technology to see farther past the bit?

PAYNE: That's right. If we could actually see what we have, if only a few feet in front of us as opposed to just being able to see what we have already drilled, that would go a long way in improving drilling performance and efficiency.

DC: In HPHT wells, is the industry more concerned with the temperature rather than the pressure, or vice versa?

PAYNE: It is a combination. There are some places where the temperature overrides. One of the problems is most of the tools start to come apart at about 350°F, so getting equipment that is reliable and affordable that you can keep in the hole past 350°F is tough. Once you get to 400°F, it is pretty much over.

In ultra-deepwater, it won't be long before you see a 40,000-ft well in the Gulf of Mexico, and that will be a pressure problem. If you actually drilled a 40,000 ft TD well, you are going to look at pressures well in excess of 20,000 to 25,000 psi.

DC: What is the industry doing to address those problems in the future?

PAYNE: Insulating is the way the industry originally went after it. The problem is it adds bulk and complexity, and it is all about how long you can stay in the hole. The real solution is not insulation; it is finding the metallurgies and ways you can put things in the ground that can handle that kind of pressure and temperature. Many MWD tools go into survival modes where they shut down because those tools generate a lot of their own heat. If an MWD or LWD tool didn't need downhole power, that would reduce the heat generated by the tool itself. If you go much past the survival temperature, they start to come apart and you have to rebuild.

The electronics needs to be enhanced and become more durable, and that is extremely difficult.

DC: What about technologies for future drilling rigs?

Q: What's the real solution to our HPHT problems?

A: It is finding the metallurgies and ways you can put things in the ground that can handle that kind of pressure and temperature.

PAYNE: An area where there is a big opportunity is looking at the mechanics of how we drill wells. There are things like cyber rigs, and there are some unique opportunities if we as an industry want to spend money. For drilling contractors, that is a tough business. They don't have excess capital to experiment with. For example, there was a phase when coiled tubing drilling was really in vogue, and a few companies spent a lot of money trying to develop systems that didn't pan out. They received no return on their capital and lost interest in continued development.

A conventional rig today and one in 1935 don't look much different. So there is an opportunity for technology advancement.

Q: What technologies do we need for future rigs?

A: We are making incremental improvements, but there is a step change opportunity.

DC: Still, many contractors have introduced some very advanced machines and for all sectors – land, shallow water and ultra-deep.

PAYNE: Yes. Basically the industry has automated and designed to take people out of the equation. They don't have to touch pipe. But at the end of the day, they are still turning the pipe, still screwing it together, still running the top drive, doing a lot of the same things, but doing it in a different way. My suggestion is there may be an opportunity where we can go back and take a white board and ask, "What does it actually take to get a hole drilled? What is the minimum amount of equipment we can put together? Is there a different, better way to go at it?"

DC: What are some of the ideas surrounding those thoughts?

PAYNE: Casing drilling is one of the approaches people take to eliminate the hoisting systems. There have been some unique things tried with coiled tubing, but they never caught on. We ran a program in the '90s where we were trying to drill with coiled tubing using hydraulic pressure to cut the rock and to steer the end of the coil. That area is not receiving a lot of focus.

We are making incremental improvements in rigs, but the concept has never changed. There is a step change opportunity. Technology is going to make the changes, but if you don't get the right people, the technology won't matter.

Right now, technology is not reducing the number of people we need offshore; it is increasing it. If you equate that to the airline industry, when they first started flying across the Pacific, it took 7 people in the cockpit to fly the plane and now it takes 3. We have got to get to that point. We used to be able to run a jackup with 50 people, and now every time a rig goes in for an upgrade, they put additional quarters on it. It is not uncommon to have 110 to 120 people run a jackup rig.

We need to get people in the industry thinking differently than the way they have been taught and the way they have historically thought about the business. There need to be some real step changes.

David Payne holds a Bachelor of Science degree in petroleum and natural gas engineering from Pennsylvania State University. He has been involved in numerous technical breakthroughs in horizontal and extended reach drilling, multilateral technology and deepwater surface stack development.