Looking into the future with

Joachim Oppelt, INTEQ

By Linda Hsieh, associate editor

JOACHIM OPPELT IS manager of client projects for **Baker Hughes INTEQ**.

DC: What will rigs of the future look like? What kind of capabilities will they need?

OPPELT: I think there will be 2 different types of rigs needed in the future.

Joachim Oppelt

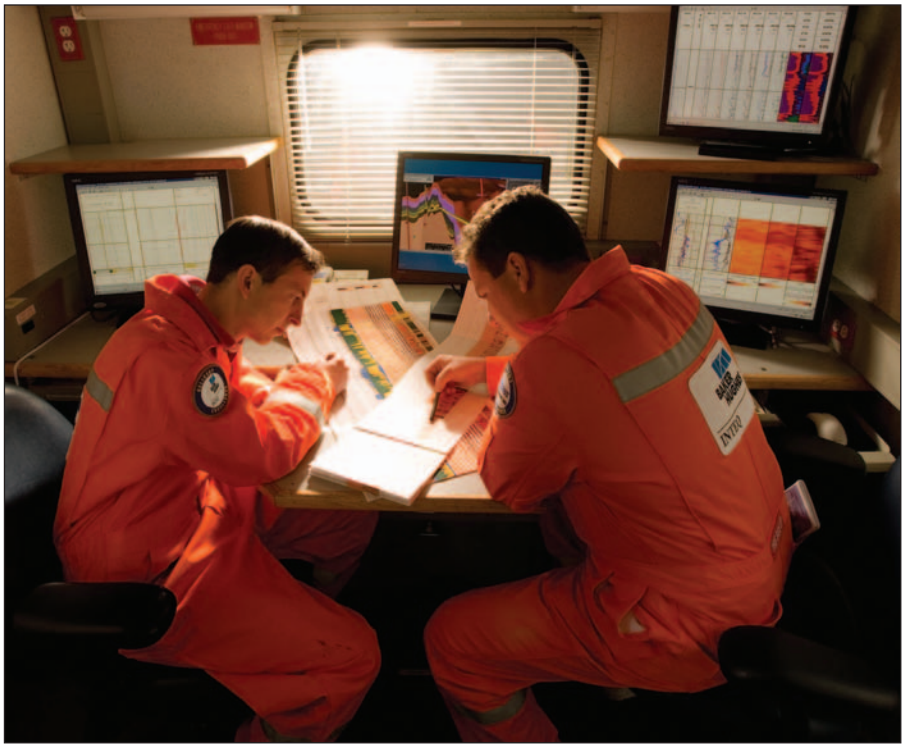
One will be a very powerful rig that has a much higher hookload capacity and hydraulic capabilities than rigs today. This is because we will have deeper wells, longer drillstrings and longer casings. On the other end, there will also be a tendency towards drilling many small holes, potentially with coiled tubing. So, rigs will be both bigger and smaller, depending on the application.

DC: What areas of innovation should the industry pursue to move forward?

OPPELT: There are 2 directions we need to explore. One, reservoirs will be more modular and scattered, so we must further improve our geosteering and navigation capabilities. In other words, we have to further equip the drilling systems with more sophisticated sensors. In order to get the data from the servers, we need a better communication line between downhole BHA and the surface. The industry is already working on that.

The second direction is in the measurement-while-drilling arena. Traditionally, we do not know what is ahead of the drill bit; it has to be guessed or estimated. We would like to develop technologies that allow drillers to truly look ahead of the bit in order to see scattered pockets of hydrocarbon reservoirs, or changes in pressure or formation far ahead so the drilling trajectory can be adapted accordingly.

DC: What is the biggest obstacle in truly being able to look ahead of the bit?



With geosteering, drillers can in real time change the well trajectory according to geological formation evaluation measurements, said Joachim Oppelt, manager of client projects for INTEQ. "It's important that those decisions about changes in steering are done in real time, which means there must be high communication speed," he said.

OPPELT: Physics. It is difficult to send waves for a long distance ahead of the bit, and there's very little signal reflection.

DC: Do you think that in 10 years the industry will have such a system and be able to use it in real time to direct the bit?

OPPELT: Yes. INTEQ has ongoing, long-term development plans.

We also see a trend that more formation evaluation senders that used to be found only in the wireline arena are now moving into while drilling. I think there will be a trend to develop more formation evaluation instruments that give indications or even readings about the existence and quality of the reservoir. For example, we're seeing more activity in developing nuclear magnetic resonance. Another area picking up heavily is formation testing while drilling. Related to that is formation fluid sampling, which is more difficult.

DC: How do you think your customers feel about rotary steerables, which many consider to be a revolutionary advance in the past decade?

OPPELT: That they have to become cost-effective for a broader range of applications and more reliable. We want to invest in reliability so rotary steerables can become a more predominant tool for the industry.

DC: What is the potential for improvement in their reliability?

OPPELT: I believe they can be 2 to 3 times better than today. Also, apart from rotary steerables, there are the sliding steerable devices, which can steer in a non-rotary mode. It is less complex than a rotary steerable system, and from that perspective it's already more reliable.

DC: But would those only be for special applications?

OPPELT: Yes, but we believe there is a hole in the market for that because

they are better than traditional steerable motors and more economic.

DC: Do you foresee growing use of drilling with casing or liner and in what applications?

OPPELT: Yes, in addition to the more complex reservoirs I mentioned earlier, there will be more mature reservoirs, which have already been drained to an extent and therefore the pressure situations have changed. That's exactly where casing or liner drilling comes into the picture. It will not replace normal drilling technologies, but it will be a more popular application for pressure-critical formations or layouts.

The same applies for coiled tubing drilling. For mature and marginal reservoirs, we see coiled tubing — especially underbalanced coiled tubing drilling — as a cost-effective method in the future.

But I want to stress that this is something we need to develop with a more systems approach, so we have all the components of the system matching each other. Many of the singular elements are there, but the systems approach is missing. This is the cheap drilling. We always talk about the two ends of the spectrum — one is the very deep drilling with big and heavy rigs, and the other end is very small drilling, and that's where coiled tubing drilling falls in. I believe the depth with coiled tubing will be extended. I think 5,000 m is a depth target.

DC: What kind of depth is it at now?

OPPELT: Typically those wells are 3,000 m or less.

DC: How do you see directional drilling capabilities improving?

OPPELT: It will be much smarter in the future. There's already a certain level of automation involved, with rotary steerable systems and sliding steerable systems. But that level of automation will be further improved. We will have even more accurate sensors for directional measurement, which is always a part of the directional drilling process. We will be steering or directing the well not only after the geometrical measurements like inclination, but we will also steer much more based on formation evaluation measurements. In other words, geosteering.

DC: Can you elaborate more on your vision of geosteering for the future?

Q: What's an important advance the industry needs?

A: We need high-speed telemetry. Coupling that with geosteering completes the picture.

OPPELT: In old times, a trajectory was planned, and the best we could do was direct the well as close as possible to this planned trajectory. You can call that geometrical steering. With geosteering, we steer the well after the geology, meaning we drill down to a certain point and start taking readings with formation evaluation sensors. What will then bring the big change into the picture will be — once we have the so-called look-ahead capabilities — then we could in real time change the trajectory according to geological formation evaluation measurements. It's important that those decisions about changes in steering are done in real time, which means there must be high communication speed, whether high-speed mud pulse or wired pipe.

There are still some simple rotary drilling, which will continue to be the main application in places like Oklahoma or Texas. There have been considerable improvements in the field of downhole motors. Within the last 20 years, the power output from downhole motors has been quadrupled. With their radically different designs, you can have much more powerful motors or reduce the section length of the motors. We can get the same power out of a 4 ¾-in. motor today as what came out of a 9 ½-in. motor 20 years ago.

DC: What is an important advance you'd like to see happen for the industry in the next 5-10 years?

OPPELT: We need high-speed telemetry. Coupling that with geosteering completes the picture. Geosteering is key, and high-speed telemetry is an enabling technology for that.

But there are more — we also need to have the processing and modeling available. For a while, people felt those tools should be put downhole. I'm not convinced of that. I believe this processing of sophisticated formation evaluation data has to be done on the surface because a human being has to have the opportunity to offer advice. I don't think you can automate the analysis of geological formation evaluation measurements completely.

On a related point, I believe that in the future, we will have fewer people on the rig, especially from service companies. BHAs may become more complex, but there will be fewer people on the rig. The data evaluation and analysis will be done in remote centers, data analysis centers or control centers. This means there will be absolute capacity. The most knowledgeable people will gather to discuss issues and learn from each other.

Joachim Oppelt graduated from Hannover University in Germany with a degree in mechanical engineering and earned a PhD from Hannover in 1979. He is manager of client projects in Baker Hughes INTEQ's Celle Technology Center.