From bore-hole to boardroom

Turning a mineral exploration drill rig working in a remote, often hostile environment, into a 'smart probe' or platform capable of performing the type of high-quality sample analysis normally done in controlled lab conditions – much faster – might sound like a pipedream or something, at least, found in the high-stakes oil search game, or space research. But it's "closer than you think", a Mining Journal webcast has heard.

Richard Roberts – Mining Journal, 20 Jan 2015

Reflex, part of Australian Securities Exchange-listed Imdex, is a supplier of drill-hole surveying and orientation instruments to many of the world's top drilling contractors, and is also at the cutting edge (literally) of advances in exploration and production drilling data management.

In a webinar run as part of *Mining Journal*'s big data management series – linked to the journal's inaugural Mining Big Data Guide (http://www.mining-journal.com/technology/mining-ict/exclusive-mining-big-data-guide-now-available/) – Reflex global product manager geosciences, Dave Lawie said real-time direction of drilling programs in the oil and gas sector was facilitated by advanced communication, analytical and in-hole measurement systems and

tools. Much of this was either already developed and being deployed, or at a conclusive stage of testing, in the minerals sector.

“I’ve been in some very large oil and gas drilling support companies and watched how they operate … [and] direct the drilling process using a combination of – beware the acronyms here – LWD (logging while drilling), MWD (measurement while drilling), AWD (assay while drilling) information; they access that data in real time and literally have command and control centres for reviewing it … with drilling experts and geoscientists on hand to look at the data that’s streaming back in real time,” Lawie said.

“When the systems are not working they actually stop drilling. They won’t drill unless they have these systems in place so that they can generate this data, because they regard it as being absolutely key to what they’re doing.”

It was the same vision being targeted in the minerals sector, which by and large hasn’t had the same stakes riding on a single, deep bore-hole. That is, of course, changing. Certainly using drilling differently in deep, under-cover (no surface indicators) mineral exploration, is a focus for the internationally-backed, Australia-based Deep Exploration Technologies Co-operative Research Centre (DET CRC), with which Reflex is involved. This research is seen as vital to discovery of new generation major deposits in Australia and elsewhere.

“We want to be able to be generating information and bringing it back to a central location as the process is going on so that people can be thinking about that and making decisions on the fly,” Lawie said.

“Generating data in real time is one component, but what we want to do is transform that data into information that allows you to make the call on it, in an intelligent way, also in real time, which I think is an absolutely critical component”

“But also using that data that is coming back to actually optimise the drilling process. We can’t forget about that key component as well. We talk to lots of drillers and drilling contractors, and people that run large drilling contracts, and they’re very excited too about collecting the measurement while drilling data. From the geological side it’s important for estimating rock properties, but from the driller’s point of view it means you’re drilling efficiently as well and you learn so that when you drill the next hole if you know you’re going through some hard ground or you’re going to start polishing the bit, you know that from the data you’ve collected from the previous drill hole, and that problem is not going to happen again.

“We’re talking about collecting this data in real time, and transmitting it back to a central location – and there is no reason why we can’t be transmitting information back to the drill rig to assist in the drilling process itself.”

On the geological front, mineral exploration may be moving quickly into a different future.

“The current exploration and drilling workflow requires taking samples in the field, despatching them somewhere, and having the samples analysed on traditional instrumentation, in laboratories, under controlled supervision of chemists,” Lawie said.

“But there’s a few things happening in the industry now that’s allowing us to take these sorts of technologies direct to the drill rig so we can start to generate this data in the course of the drilling process.

“So at the moment we have a situation where the analytical technologies that are used are the size of washing machines, controlled by experts in controlled environments. What we’re working on is taking advances in these technologies, which miniaturise it, or certainly make it a smaller form-factor, make them field-robust and portable, and adapting those various sensor packs, so they can be used at the drill rig during the course of the sample drilling process.

“That’s one part of the work we’re doing.

“It’s very important to remember though that apart from the very sensitive machines that we have in labs, there’s the vital process of preparing the sample before it gets to these machines. So a key component of what we’re also doing to take this technology out into the field is to work on in-field sampling systems which can be adapted to diamond drilling, but also RC-type drilling, and grade control drilling. So we can take the materials, literally as they’re being generated at the rig, comminute them, dry them, prepare them, turn them into a very dry, free-flowing powdered material so that we can then present them to these sensors and generate that data, as we go, in real time.

“There are lots of components in this chain if we’re going to achieve this in the field and we’re working on all of them. But this ability to prepare a representative sample in a very consistent way and present it to the analytical technology is absolutely key.”

The significance of this to an industry in which greenfields exploration success is becoming more challenging, and technology isn’t yet the bridge it can be connecting the ‘art’ of finding new deposits, with the increasing scientific understanding of rocks and mineral systems, is potentially profound.

Lawie [pictured rigth] said generating the assay data that shapes decisions on drilling programs was typically taking anything from three weeks to two months “if things don’t run off the rails”.

“We want to take this process from the borehole to the boardroom as the holes are being drilled,” he said.

“You can imagine the knock-on effect of this.

“It will give you the ability to change direction, and make decisions, actually while you’re doing the work. In a greenfields environment you may run the risk of running a programme and demobilising even before you get your data back from the laboratories. What we’re saying here is as you’re drilling you’re making a call on what you’re doing as the drilling process is taking place. So that can be extending drill holes, re-prioritising drill holes … and of course the other benefit here is it might enable you to leave a project – to make a decision to get out of there faster, which can be equally significant.”

Lawie said the minerals exploration industry didn’t just want more data, it wanted information.

“So generating data in real time is one component, but what we want to do is transform that data into information that allows you to make the call on it, in an intelligent way, also in real time, which I think is an absolutely critical component.

“There are statistics around, not just for the mining industry, that say industry in general only uses 15% of the data that it ever collects. We don’t want to get into a situation where we’re putting lots of new sensor technology in the field and not helping people use it.

“And so we think that a key parallel development in working on the technologies, getting this real-time data into the boardroom, is giving people the ability to quickly make decisions based on the information.

“The other key component here is that when people think about this work and try to imagine what we’re doing, they think along the lines of what they traditionally do with the drilling materials now, which is typically send it in for assay – maybe just for commodity elements, or a few other elements, maybe even a whole rock analysis [to] get a more comprehensive assay – and we’re going to achieve that, but what we’re also doing is extending the types of data we’re collecting to increase direct estimates of the mineralogy of the materials.

“Apart from XRF technology we’re working on real-time XRD technology as well. This is quite tricky because a lot of the sensor technology that we’re looking at deploying has traditionally required what I would call white coats to interpret [data] when it comes back. Obviously we can’t go with a workflow like that when we’re working in an automated system, in real time.

“So another key component we’re working on is automated processing of the various data sets that come back so that as you’re drilling not only will you see the assay, you’ll see the mineralogy.

“That might have some lead-zinc-copper anomalism, but it will tell you if there is some albite kicking around at the same time, as the drill-head is literally cutting the rock. That means that the application space for these technologies is quite wide.

“In an exploration context we can of course talk about greenfields drilling, but being able to generate these other data types – the estimate of the mineralogy, for example – takes us right through into brownfields drilling, and the production environment where we figure … and I’m pretty confident that these new data streams that will be available at the sample scale … so high-density data, and that will have a very large impact on geometallurgical modelling.”

Lawie was joined on the webcast by Reflex geochemistry and global operations manager, Michelle Carey, and principal geochemist James Cleverley.