# THE DYSLEXIC MENTOR

## Decisions and Discovery—Upgrading to "Truth Machine 2.0"

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*Opinions expressed in this column are the authors' and do not necessarily reflect the opinions of the SEG.*

*"This is your last chance. After this, there is no turning back. You take the blue pill—the story ends, you wake up in your bed and believe whatever you want to believe. You take the red pill—you stay in Wonderland, and I show you how deep the rabbit hole goes. Remember: all I'm offering is the truth. Nothing more." – Morpheus to Neo, The Matrix, Film, United States: Warner Bros., 1999.*

### Drilling and Decisions in the Discovery Process?

Drilling holes is the universally accepted means to find orebodies, so much so that some have nicknamed the drill a "truth machine." Regardless of your take on snappy monikers, at some point, to advance the process of exploration, you need to drill a hole; this is a critical hypothesis test designed to support a decision. It is true regardless of the type of program—e.g., early-stage exploration, resource definition, or active mining—or the type of drilling—e.g., RC, RAB, DD, or blast hole.

This is termed the drilling "life cycle," as illustrated in Figure 1. It is an interactive process whereby we drill the hole to recover a sample and thereby generate data, then interpret such data, present this new information to our model (whether to confirm or test a hypothesis), validate or upgrade the model, and make a decision as to how next to proceed. If we make the choice to proceed, it often results in the next test, i.e., drilling another hole.

However, our industry is suffering from a systemic problem with this process—the historic time to complete this cycle is now too long. Depending on the style and stage of the program, this cycle might be anything from 72 hours to 6 months, but, in all cases, it is no longer fast enough. This protracted action-to-decision time is causing wasteful expenditure, leading to higher technical and, ultimately, business risk, which erodes shareholder confidence and the value of the enterprise.

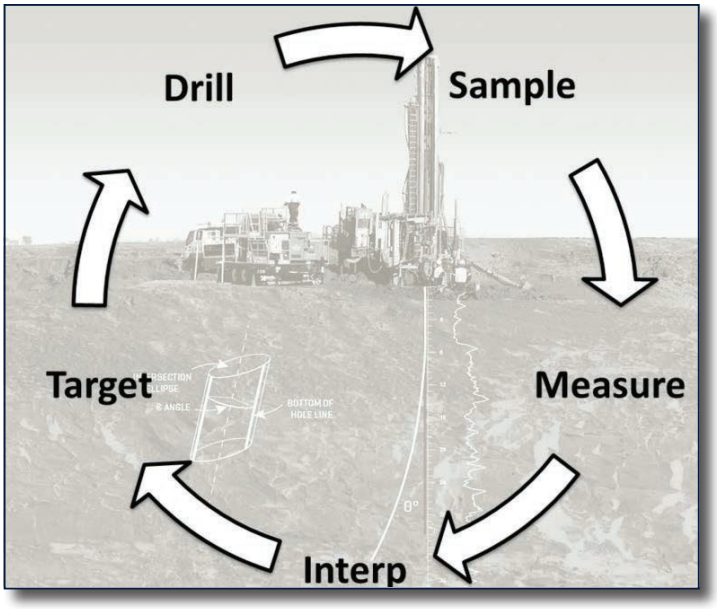


**FIGURE 1.** The drilling life cycle in the minerals industry. Interp = interpret.

This problem is being addressed with technology development inside Australian national research organizations and the Mining Equipment and Technology Services (METS) sector. An example is the Deep Exploration Technology Cooperative Research Centre (DET-CRC), which has used this vision to drive research into innovative technology designed to speed up and reduce the cost associated with the critical steps in the drilling life cycle, specifically the process of drilling the hole and the capture and measurement of target geoscience data derived from the drilling process (Giles et al., 2014; Hillis, 2015). The goal is to drill faster and cheaper and have rapid turnaround of geoscience data captured in the hole, including detailed petrophysical and geochemical analysis. This appears to be technologically doable and will significantly compress the drilling life cycle and provide the data needed for more rapid decision-making, thereby enabling a potential step change in the overall process. But while a more efficient process will likely ensue, the real value is if exploration effectiveness is commensurately improved, as well. For this to happen, we need to understand where in this cycle the critical decisions are actually made by the geoscientist and what the broader consequences of moving to a near-real time workflow would be. Without keeping in mind the need to balance both efficiency and effectiveness, we run the real risk of delivering data faster than we can support decision-making by the geoscientist.

### What Do Near-Real Time Workflows Mean?

What are the consequences and benefits to the minerals industry of developing a true near-real time geoscience workflow and reducing the time to decision for the drilling cycle? There are a number of business and human factors that need to be considered if we are to realize a positive outcome from deploying these new technologies in the exploration process.

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**Regulatory Processes:** One clear consequence of the near-real time workflow will be challenges relating to the regulatory processes, corporate control, and social licence to operate. In many parts of the world, the current processes of permitting and land clearance for drilling are prescriptive and constrained, but, in this new paradigm, drilling becomes almost an interactive tool of investigation and, thus, we can't predict with certainty where or if we will continue drilling until we are have finished hole number 1. On the flip side, these workflows should lead to a lower overall environmental footprint. This trade-off between needing rapid permitting but showing better overall environmental performance should be reflected in an improved social licence to operate, but it needs support from the regulatory organizations. Generating high-quality assay information while still drilling will also challenge current stock exchange reporting schemes, which typically give companies months to report results following conventional drilling programs. In terms of precedent, the introduction of portable XRF to the minerals industry started around 2004 with mainstream uptake around 2008; the JORC reporting code was updated in 2012 following three to four years of discussion. This is an ~8- to 10-year adaptation cycle.

**Internal Business Process:** The new way of drilling will profoundly impact how exploration is conducted and managed. Our current paradigm will move from campaign-based to continuous exploration. What will this mean for internal processes and systems? We will need to change the way we operate the business—yearly budget cycles will be too long, procurement and contractor processes will lag, and our ability to report upward and outward will need to be aligned with the new speed of operational decision-making. The business will need to evolve from "waterfall" to "agile" project management processes, well described by Eric Ries in his book, *The Lean Startup*, and adopted by many technology start-up companies.

**Shareholder Value**: The ability to make a decision quickly will impact the way value flows to shareholders in a company. The management of failure and the ability to make a decision to walk away will change our ability to test targets. As an example, the ability to make fast decisions allows a fixed exploration budget to continually test sequentially prioritized targets rather than commit to one target awaiting test results. If we can, with certainty, walk away from a target with one drill hole, that same budget can then be used to test subsequent targets. This change in exploration workflow would realize greater value for shareholders by minimizing waste and improving the chance of success. Bell (2015) makes the point that walking away is as much about building confidence within the team to accept failure as it is about quantified risk: "It's remarkable how often the risk-project team members fall in love with their work. They want to keep going, even after they've missed the agreed-upon milestones. They are on a mission" (http://read.bi/2nYeUKT).

The consequence of this approach and the speed to decision in the near-real time workflow will also lead to changes in the life cycle of companies. With faster decision-making and reduced time to results, a company's major milestones will be much closer together. The chances of going from "feast to famine" (or the reverse) in a short period of time are much greater. Managing such an enterprise will not be for the faint of heart.

**People and Skills:** The job of the geoscientist will change, but this is not about removing the geoscientist; instead, the role will evolve from data collector to data interpreter. Our future graduate geoscientists must still have all the fundamental geological knowledge but with a stronger framework of numeracy and pure science to allow them to work with the digital integration and analytics that will underpin decision-making. Future employees are already going to be more technology savvy, having grown up with user-centered workflows on their personal devices. Still, they will need to develop better skills in critical assessment of real-time information products. Where they will learn these skills is an interesting issue, and eventual success of the technology will likely be highly dependent on "getting this right." Currently, neither academia nor industry has any serious capacity in this area of learning.

## Coupled Technology and Business Change

As the saying goes, "truth is in the eye of the beholder," and, in many respects, the truth machine (aka drilling) operates under the same principle. Some believe that there is no such thing as a "bad" drill hole even if no real target was defined ahead of time and no serious effort made to use the new information to update the target model. Others regard drilling as if it were sacred beans that should only be portioned out sparingly, and only after all manner of targeting work is carried out. The new reality is that before too long, a near-real time drilling cycle will be available that should allow for many more targets to be tested for the same cost, thereby increasing the chances of discovery. The opportunity for misuse, as happens with the current truth machine, is still very likely, especially for those who choose to treat the new technology as a silver bullet. Success will most likely come to those groups who accept the need to change their internal approaches to model building and model testing and make efficient use of information never before available to explorers, in such quantities at least. While it is a given that there will be huge changes in the type of decisions being made, where and when they are made, and by whom, the key to the successful implementation of the near-real time workflow may be less about how the decisions are made and more about asking the right questions along the way.

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