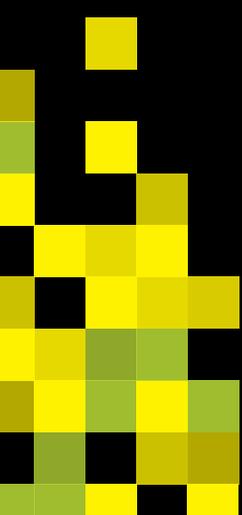


MINING

smarter.
better.
faster.
safer.

The future is here. Armed with drones, autonomous vehicles and high-tech operations centres, the big players in the resources sector are mining digital technology for all it's worth, as **Jane Nicholls** discovers.





SINCE THE first gold rush, the extraction of minerals and metals from the ground has been dirty, dull and dangerous.

But over the past decade, Australian companies have been at the forefront of swapping mining's infamous "three Ds" for a single new one: digital.

Technology is moving human jobs up the value chain, out of mining pits and truck cabins and into air-conditioned remote operations centres. Today, mining groups boast data-gathering sensors, drones and autonomous trucks and trains – and this is just the beginning. Here, we find out how five top Australian companies are using digital technology to change the art of mining.

Real-time data lets BHP staff monitor mine sites that are hundreds of kilometres away (above)

■ remote operations.

When BHP Billiton was planning its first integrated remote operations centre (IROC), a dedicated team spent more than a year investigating the concept and toured leading remote operations centres from other industries.

With global research under its belt, BHP opened its first IROC in July 2013, centralising control of its Pilbara mines in a Perth office, 1200 kilometres south of the sites. "Over and above everything else, technology is a safety enabler," says Edgar Basto, asset president for BHP's Western Australia Iron Ore business.

"The more people we can remove from exposure to hazards, the better."

At the IROC that never sleeps, dozens of big screens give staff real-time vision of every critical stage of the mining operation, from the fixed-plant machinery to the loading of ships at the dock and the unloading of trains. Streams of data come in from sensors, CCTV and radio systems, the latter enabling the Perth team to communicate with the mining sites. That means instead of having multiple teams in various locations, key decision-makers now share the one office space.

Having a "bird's-eye view of the whole operation" greatly speeds up problem-solving and efficiency-spotting, says Basto. People "can walk over to their colleagues and discuss their ideas while looking at everything in real time – no more calling around, trying to find the right person then trying to coordinate changes all day over the phone. We have the right people having the right discussions at the right time, collaborating as one team and making faster decisions."

The Perth centre is the blueprint for BHP's IROC concept: a Brisbane office was built in nine months at a third of the cost and late last year BHP announced that an Adelaide IROC will come online for its Olympic Dam mine in 2019.

As well as using cutting-edge tech – such as virtual reality to simulate real-time train unloading – BHP fosters innovation at its IROCs by recruiting from outside the mining industry. Working at the coal centre in Brisbane are former air-traffic controllers, medical scientists and triple-O dispatchers – and more than half of the staff are women. The rise of the IROC has created more jobs in CBD offices, giving mine workers a chance to relocate to a capital city.

■ autonomous trains.

Rio Tinto kicked off its Mine of the Future initiative in 2008 and last September reached a significant milestone in that journey: the pilot run of a driverless train across the Pilbara. The crossing – almost 100 kilometres long – marked the first autonomous heavy-haul rail journey ever completed in Australia.

Driverless iron-ore trains will soon run across Rio Tinto's entire network, the culmination of years of testing, regulatory approvals and collaboration. The mine's network is no slouch in terms of distance and complexity: there's more than 1700 kilometres of track, which connects 16 mines and four ports, all controlled from a remote operations centre in Perth.

"AutoHaul is a Rio Tinto technology, working with Ansaldo, Hitachi and GE," says Chris Salisbury, chief executive of Rio Tinto's Iron Ore group. "We anticipate that by the end of 2018 we'll have fully implemented the system."

Drivers will still operate trains in rail yards but not on the main line. "Our trains cover more than 55,000 kilometres a week," says Salisbury, "and we increasingly see automation as an engineering control to remove people from the risk of fatigue."

The main aims of AutoHaul are twofold: to operate the trains nonstop and run them more efficiently. "At the moment, we lose about half an hour every 12 hours by taking one driver off the train and putting on a new driver," explains Salisbury. "Autonomous trains don't have to stop for a shift break."

The efficiency gains come from algorithms that can drive trains with a precision that's simply not possible for humans. "There's more speed, less wear and tear, and absolute compliance because you only have to teach the system once. Once it knows how to drive perfectly, it drives perfectly every time. It's like sophisticated cruise control."

The Rio Tinto team behind Australia's first autonomous heavy-haul rail trip (above)



■ driverless trucks.

Heavy-haul truck systems that operate around the clock without drivers are one of the most revolutionary technologies for mining operations. Fortescue Metals Group was the first company in the world to use Caterpillar's autonomous haulage system (AHS) on a commercial scale.

The majority of its Cat haul-truck fleet is scheduled to be automated by mid-2020, when a total of 170 trucks will be in service across all mine sites. Since coming into use in 2012, driverless trucks have already moved more than 420 million tonnes of iron ore at Fortescue's Solomon Hub operations in the Pilbara.

The miner says it's getting more out of the technology than any other company. "We're effectively using Caterpillar's off-the-shelf product; if you think of an app on an iPhone, the smarts come in how you use it," explains Greg Lilleyman, Fortescue's chief operating officer.

His point is that if you "have a mine that's poorly run, inefficient and sloppy and you put in autonomous trucks, you've now got an automated, poorly run mine". Since introducing AHS, Fortescue has realised 30 per cent productivity gains and Lilleyman expects that figure to grow.

Critical to getting the most from the system, he says, has been "how we've set up the pit – the environment where the trucks drive – and the way we've altered our road networks to maximise a robot truck set-up versus a manned operation".

Some former drivers have become virtual pit builders and technicians (they are part of the team designing the most efficient road networks for the trucks) and they're using manned bulldozers to reshape intersections. The changes to roads are based on data from the automated trucks coupled with the drivers' knowledge.

Safety, of course, improves out of sight when algorithms are in the driver's seat. "You can be 100 per cent sure our strict rules will be followed," says Lilleyman. "As much as there are strict rules, humans don't always follow them."

All the same, he adds, "we're not automating for the sake of saying, 'We're very high-tech.' Any part of the business that we think has potential for automation has to stand on its own two feet as an investment decision."



■ industrial drones.

Maintaining security, safety and inventory accuracy across the vast footprint of a mine is a logistical puzzle that can be made easier by a data-gathering drone.

Resources giant South32 last year announced plans to fast-track its digital transformation. It began deploying Airobotics drones for surveying and inspection work (known as “missions”) at its Worsley Alumina mine in south-west Western Australia in the second half of 2017. It will do the same at its bauxite site, near Boddington, south-east of Perth, this year.

Israeli startup Airobotics claims it’s the first company to develop an autonomous drone that’s up to this kind of mining work. “We target routine missions and activities and we automate those missions to be done using our drone,” says Yahel Nov, vice-president of business development for Airobotics. “Drones automate missions that are dull, dirty, dangerous or all three.”

The Airobotics drone lifts off from an air base – which looks like a giant photocopier – and removes humans from such reporting jobs. The drone flies to its assigned position before returning to base after about 33 minutes. (It will soon be able to fly for 44 minutes and even longer as battery quality continues to improve.)

Not only is there no human physically inspecting a perimeter, pit, stockpile or pipeline, there’s no human piloting the drone, either. “We do a detailed risk and

aviation assessment of the site to get a deep understanding of the facility and where it’s safe to fly and where it’s not,” says Nov.

“We invest a couple of weeks in that planning to customise the mission precisely; once that’s done, you basically press play and repeat the mission as many times as you like.” Numerous operations can be programmed for the drone but typically about a dozen high-value missions are customised for the site.

The scope is broad, he says: “the drone can acquire information from the mine at very high frequency with very high accuracy, rather than people getting into a light truck and going down to a pit”. The drone can fly night or day and the data it picks up can be watched live. The video can be condensed into a shorter version or combined with software that will analyse the information.

The path of an Airobotics drone, as viewed on a computer. Once a mission is programmed, no human intervention is required

■ real-time fleet management.

In July last year, the Chinese-owned magnetite miner CITIC Pacific Mining (CPM) was among the first companies in the Asia-Pacific region to go live with SAP Vehicle Insights (an application that collects, stores and analyses transport data). CPM uses the tech across a fleet of light vehicles, buses and service trucks at its Sino Iron project in the Pilbara.

“Our operating footprint is over 40 or 50 kilometres so it’s a nightmare to manually track a fleet of more than 230 assets,” explains Ray Achemedei, general manager of information services for CPM.

Deploying sensors on its fleet and pairing them with software means the days of scheduling maintenance based on kilometres are gone. Vehicle information is now automatically collected and reported; for example, engine alarms are flagged at the central control so trucks can be called in for urgent work, even if the driver has missed the initial alarm.

Achemedei believes the value of the data insights will continue to grow. “Intuitively, we thought there may be more assets out there than we need and now we have the data to measure that,” he says. “We can see how long vehicles are standing still in a particular location and we’ll be able to use the data to optimise the size of the fleet. That will reduce our capital investment and lower operating costs, as it will mean less maintenance, less fuel. So it’s a world of opportunities for us.”

Another benefit of the automation is that it enables CPM to accurately and automatically claim the fuel-tax rebates available to miners. “The rebate is only for vehicles when they’re operating on the mining lease,” says Achemedei. “Historically, it’s been difficult to do but now we capture the vehicle information, geofence it [create a virtual boundary of the mine site using GPS and sensors] on mapping systems and collect auditable proof of when the fleet is on the lease.”

Future possibilities include extending similar tracking to other mobile mining assets – generators, lighting plants and so on – to make them easier to track for maintenance, refuelling and when they’re urgently needed. ●