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Miner Digs for Ore in the Outback With Remote-Controlled Robots

By [ROBERT GUY MATTHEWS](#)



Christian Sprogoe/Rio Tinto

Employees at Rio Tinto's operations center in Perth, Australia, manage machinery hundreds of miles away.

[Rio Tinto](#) is connecting its Australian mines to satellite links so workers more than 800 miles away can remotely drive drilling rigs, load cargo and even use robots to place explosives to blast away rock and earth.

The company's Perth operations center, which relies on banks of high-tech equipment to manage one of the oldest and dirtiest jobs around, is a harbinger of new techniques that are allowing miners to go to more remote places, dig deeper and get ore to the market more quickly. It also aims to save Rio Tinto money by using fewer workers and keeping them out of harm's way.

"We have invested tens of millions of dollars," said John McGath, Rio Tinto's head of innovation. He declined to disclose how much has been invested or saved, or how many jobs had been affected. The innovation is born from necessity. Easy and accessible mineral reserves have been largely tapped, pushing miners to search more remote locations for iron ore, copper, coal and other metals and minerals. The shift could help Rio and other miners recruit employees who don't want to work in remote locations that might be more politically and environmentally hostile.

"The mining industry has been very innovative," said Andrew Keen, mining analyst for HSBC Global Research, "using technology to take costs out of its business, to compensate for the decline in quality of reserves."

[BHP Billiton](#) Ltd., the world's largest mining company by revenue, has teamed up with [Caterpillar](#) Inc. to engineer driverless trucks. "We have various bits of automation though no vehicles at this stage," said BHP spokesman Ruban Yogarajah. Vale S.A., the world's second-largest miner, has automated conveyor systems and remotely operated machinery.



Christian Sprogoe/Rio Tinto

A Rio Tinto drill rig in the Pilbara region of Australia tests the rock for iron ore based on GPS coordinates received from the operations center.

Rio Tinto, however, is more involved in automation and remote operations, using a labyrinth of cables, satellites and Global Positioning Systems in the Pilbara region of Australia. Rio Tinto controls about 23% of the world's seaborne iron ore, with most coming from Pilbara.

That remote northwestern portion of the country is noted for cyclones and poisonous insects and reptiles. During the economic boom, miners had trouble recruiting workers, who would fly in on company planes and stay for several weeks in company housing before flying back home. That arrangement was costly, as were wages and overtime, which boosted annual pay to more than \$100,000, even for unskilled tasks.

Robots can drill about one million holes into the ground automatically in one year, eliminating thousands of man-hours of work. The holes are drilled short distances from one another to test the rock and ore underneath the earth and determine the width and depth of the reserves.

At the Pilbara mines, robotic machines monitored by electronic eyes that transmit images and data back to the Perth operations center scoop out ore, dump it onto conveyor belts and spray it to remove dirt and reduce dust. Once an area in a mine has been processed, the robotic machines portion out volatile explosives, reducing the potential for injuries.

Rio Tinto must walk a fine line with its unions in Australia. Too much use of automation, at the expense of jobs, is sure to raise the ire of the local unionized work force. The issue, though, hasn't yet become a sticking point because the iron ore mines in the Pilbara are running at 100% capacity and job creation isn't threatened. The issue could bubble up quickly into a problem for Rio Tinto if it is seen by the union as targeting good jobs and replacing them with robots.

Rio Tinto began testing its remote operations project about five years ago with one mine in the Pilbara region, which was linked to a small operations center in downtown Perth. It has since built a larger operations center near the Perth airport, which employs 300 and monitors and controls some aspects of 11 mines in Pilbara.

One of the troubles, said Mr. McGagh, was configuring the wireless networks so they wouldn't get blocked by hilly terrain between Perth's airport and the Pilbara, where the land is mostly flat.

Another concern was making sure there would be enough security so a computer attacker couldn't electronically take over the mine. "We have a whole army of security geeks," said Mr. McGagh. "We needed massive amounts of security and physical security deep inside to prevent a takeover."

Inside, the control center engineers monitor giant screens and set movements for the automated machines. The center is divided into three circular clusters. One is devoted to actual mine operations, which monitors the drilling, excavating and testing. The second monitors the railroad, showing where the trains are and how to most efficiently run trains from mines to port. The third cluster controls the Pilbara port, where company-owned trains dump iron ore into the waiting ships.

Rio Tinto is also trying to develop a driverless truck for mines, which would avoid having human drivers involved in moving truckloads of dirt and explosives from one part of the mine to another. The company is also studying how to safely use a manless train, such as those used to carry passengers at some airports, over its 700 miles of private tracks. At this point, Rio Tinto's rail system has some functions automated—such as timing, loading and delivery—to avoid bottlenecks. But the train itself is still driven by an onboard engineer.

Getting employees comfortable working alongside robots took time. But Mr. McGagh says workers have come to value the reliability of the robotic systems. "People feel safe around the robots because they are predictable."