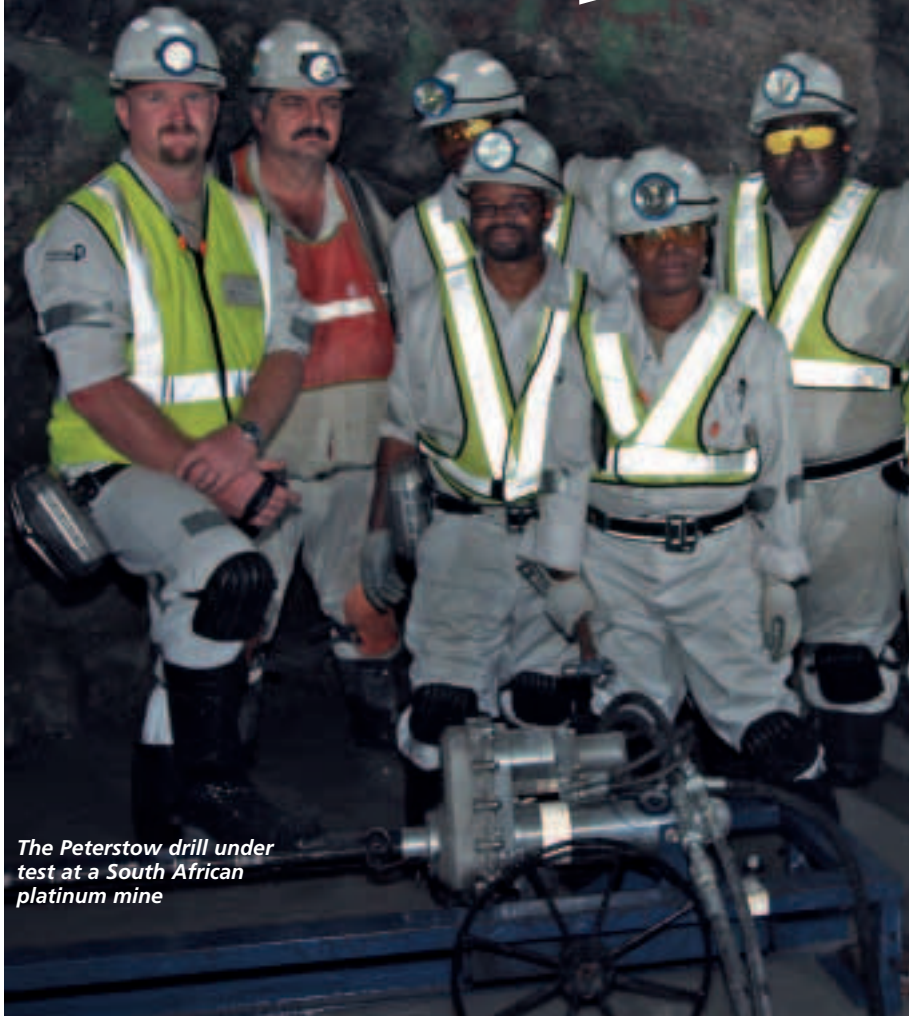


Water power



The Peterstow drill under test at a South African platinum mine

New life for South Africa's precious metal mines – an innovative drill, made in Swaziland, could cut gold and PGM mining costs significantly, arresting the decline in South African gold production and solving some of the power issues of all the mines.

John Chadwick met with Douglas and Alan Barrows at the Peterstow Aquapower facilities in Ngwenya

The technology represents the life's work of entrepreneurs Douglas and Alan Barrows. Douglas told *IM*: "We believe this is the single most important piece of technology to hit the mining industry in 50 years. The interest we have received already reflects how important this will be for the industry. Product is currently being delivered." Units are at work in mines in Norway, Uganda and South Africa.

Major South African mining companies are excited about this new environmentally friendly and more efficient drilling technology, available immediately from Peterstow Aquapower. It can revolutionise the South African gold and

platinum mines that currently use compressed air, and other handheld drills, with two leading mining houses already at advanced stages of evaluating the technology as a precursor to possible introduction to their mines. The power and infrastructure saving advantages coupled with greater efficiency all add up to more blastholes for your buck, so this technology could even reverse the decline in South African gold production. It could also support the rise in South African PGM output that the world is currently demanding, but which is looking shaky with power shortages certain to return.

Pumping water and energy down deep, South African mines, and removing and

disposing of it, has proved so expensive that some mines have struggled to stay profitable.

Peterstow's new drilling system for hard-rock deep mining use less than 0.01% of the energy required by some existing systems and 60% less water. In addition to dramatic cost savings, it will help companies respond to increasing regulatory and political pressure to improve energy efficiency.

The Peterstow system cuts capital cost by eliminating the need for much of the underground infrastructure needed for traditional hard rock drilling processes, such as compressed air reticulation columns and high strength water piping.

The system uses Peterstow's patented closed-loop water hydraulic technology and modular power packs. The closed-loop design dramatically cuts water usage and ensures a more efficient transfer of power to the drill with greater reliability than existing technologies. It reduces water wastage and flooding which allows for the reduction of pumping facilities, opening up additional opportunities for savings.

Ian Cockerill, former CEO of Gold Fields and an advisor to Peterstow, commented: "This is a breakthrough technology which can give a huge leap in productivity. This kind of innovation means the mines can still operate while reducing their power requirements, and at the same time get a much more efficient drill which gives you more operating time at the face.

"From work done to date, it appears there is a real financial case to change from the high pressure water columns driving conventional drills to Peterstow's remote operated closed-loop water hydraulic system. Mines are going to come under huge pressure as significant consumers of power. But big business like mining has the capability to put in place a game changing technology, and this is a game changing technology," Cockerill said.

"I think it's a great technology for South Africa, but one that also answers some key problems for the global industry," he said. After many years as an advisor and much 'hands-on' experience, he is also very impressed by the reliability of these drills.

The technology

The drill weighs 29 kg, though substitution of some appropriate components with non-metallic alternatives, currently under development, will bring this down to around 25 kg. It uses 25 mm hexagonal drill steel. The water flow is 36 litres/minute at 110 bar pressure, recycled through the 'closed-loop'. Energy consumption is 9kW/h (drill and rig)



Douglas Barrows at the factory in Swaziland

and 1,950 blows are delivered per minute.

Penetration rates are considerably faster than competitive drills but will obviously differ significantly with rock type and other conditions. Suffice to say I saw it drill some of the hardest granite to be found (500 MPa) with ease. The average South African gold drill operator might be encountering 200 MPa. The drill should be able to drill a 1.2 m hole about six times faster than conventional drills but, allowing for differing setup times, it would

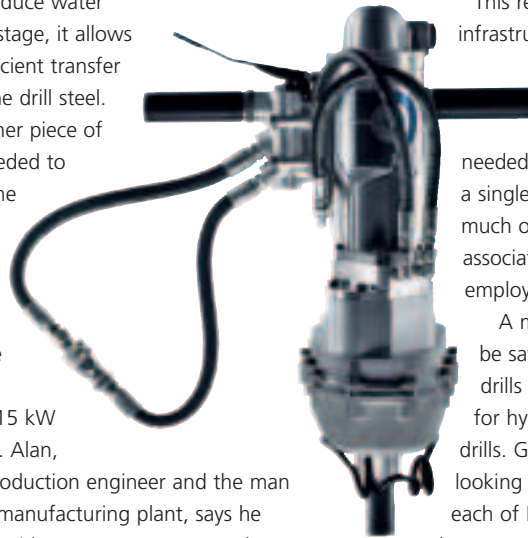
certainly be safe to expect a speed of about three times the norm.

Not only does the closed-loop system dramatically reduce water usage and wastage, it allows for a more efficient transfer of power to the drill steel.

The only other piece of equipment needed to start work is the Peterstow power pack. Two electric versions are offered for the drills – 7.5 kW (stopping) and 15 kW (development). Alan, trained as a production engineer and the man who runs the manufacturing plant, says he could easily provide even greater power than the 15 kW unit, but would not do so for a handheld machine – but who knows what the future may bring for rig-mounted Peterstow drills?

Thus, high performance is provided from a very reliable and mobile power source. It is robust in design for underground use, quick and simple to maintain and safe and easy to handle – compact and portable, easy to

manoeuvre in confined spaces. It weighs 275 kg is 790 mm high, 650 mm wide and 850 mm high.



This reduces the need for infrastructure such as compressed air reticulation columns and high strength water piping as everything needed is taken down the mine in a single unit – which cuts out much of the waste currently associated with deep level mining employing handheld drilling.

A major investment that can be saved by using Peterstow drills is the huge water columns for hydropowered underground drills. Gold Fields, for example is looking at \$43 million to replace each of Kloof gold mine's water columns.

The specific benefits of Peterstow technology include:

- The water consumption of Peterstow closed-loop drills is around 2 t of water per tonne of ore extracted. Existing 'open-loop' hydraulic technology uses 5-6 t of water per tonne of ore. Peterstow has calculated that for every 1,000 of its drills used, the water required

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by the South African mining industry can be reduced by over 20 Mt/y

- By improving energy efficiency and eliminating the need for inefficient infrastructure Peterstow drills can use less than 0.01% of the energy required by some existing drills. 500 Peterstow drills would use 22,500 kWh of energy in a month, based on a six-hour daily drilling period, compared to pneumatic drills, which can use 3 million kWh. The technology enables mine operators to substantially reduce energy consumption.

- Capital costs per 1,000 Peterstow drills are around \$18.5 million, compared to \$40.17 million for the equivalent in pneumatic drills, including necessary infrastructure

- The core technology also has potential for further applications, including mounting on carriers for drill jumbos.



Peterstow power pack underground - compact and efficient

The arguments

Recent comments made by industry leaders such as Harmony Gold's CEO Graham Briggs underline the need for the South African gold mining sector to look closely at power costs, and support the argument for Peterstow drills. Just after I returned from Swaziland, at the start of November, Briggs said that new long-term electricity-intensive gold projects are being rendered unbankable in South Africa because of the uncertainty surrounding the future price of electricity. "Increased electricity cost risk is one thing that comes out very strongly in feasibility studies," Briggs told *Mining Weekly Online*. So, some South African projects cannot achieve bankable status and lose out to more attractive projects outside the country.

Increased electricity tariffs plus winter surcharges were among the main reasons for Harmony's cash operating costs rising by R238 million, 11.2%, in the three months to September 30. Harmony's Evander gold project in Mpumalanga currently fails the economic test because of power price uncertainty. Maybe the aquapower technology would be a solution? "There's a lot happening everywhere in the world in minerals, but unfortunately it's not happening in South Africa," Briggs says. But this can be just where the Peterstow drill tips the balance. The huge investment in massive compressors and underground reticulation for the classic South African deep mine can all be done away with.

Similarly, Gold Fields CEO Nick Holland said

in early November that the South African gold-mining industry is facing "very significant" challenges. Speaking at a Gold Fields media round-table briefing cited the main problems as the legacy of above-inflation wage increases over the last decade and beyond, as well as Eskom electricity price increases.

Briggs also said: "The more people you have underground, the more likely you are to hurt somebody." This is another point in favour of the Peterstow technology. Reduced numbers of drilling units and less infrastructure to manage and maintain underground, means less people for the same gold output. Besides which, these drills are much safer than the handheld units used commonly today. These drills improve working conditions by reducing dust, noxious fumes and noise pollution, whilst virtually eliminating the risk of electrocution (electric handheld drills are also in use in some of the mines) and oil leaks.

Anyone who has worked with compressed air drills (as many of us have in our pasts) will be familiar with the oil mists they produce – those are eliminated with the Peterstow drill. This technology provides greater health and safety for workers, and reduces fire and electrical hazards. Focussing for a moment on noise pollution – a conventional pneumatic drill could be 16 times noisier than a Peterstow drill!

Analysts too have also recently added their voices to the argument for power solutions. In October RBC Capital Markets noted that South Africa has been plagued by a power shortage since early 2008. "Over the past two years, the situation improved only because the economic environment slowed dramatically, reducing electricity demand. At the same time industry, mining specifically, reduced power consumption by at least 10% - partly due to

lower output, but also due to taking steps to be more power-efficient." See <http://www.im-mining.com/2010/10/18/south-african-pgms-the-power-squeeze/>

The "risk [of more big power shortages] has increased significantly on continued indications of delays to the build program of two very important coal-fired power stations that are due to come on line. Most recently, the South African government published two reports that clearly indicate the problems

and look at how these challenges plan to be met," RBC said. It seems that power consumption will have to be cut if the country is to stay "switched on". RBC says "the conclusion is pretty clear" and believes this points to things that are "crucial to mining, but particularly to PGM mining in South Africa," including:

1. Current expansion plans from the majors should really be questioned
2. Significant cost increases are now a given - as result of higher power costs, but also on possible disruptions.

Swaziland?

Peterstow has built its worldclass high-precision production factory on a site in Ngwenya, Swaziland, 3km from the border with South Africa, where it employs more than 110 people. The location provides strong transport links to key parts of southern Africa, and offers ample opportunity for expansion to meet increasing demand. Nevertheless, there will be those that ask – why Swaziland?

The Peterstow factory is an easy four-hour drive from Johannesburg – perhaps five hours to the gold mines of the West Rand. The company has had, and continues to receive, tremendous support from the



Alan Barrows

government, with never a suspicion of the any of the irregularities that can be found in so much of Africa when investing in a country.

Peterstow's investment in the country tells of great commitment. It is the biggest single investment in the country for many years. Douglas says "Swaziland is a friendly, stable country with a workforce that is keen to learn. He describes the factory as "possibly the best manufacturing plant in Africa."

That facility is equipped with a number of multi-million dollar machine tools. The most expensive is so sophisticated that there are only two other comparable units in the world – one owned by Rolls Royce for making jet engine components, the other owned by Airbus Industrie.

Alan stressed the importance of high precision manufacturing and attention to detail on a tour of this very impressive facility, which will soon be ISO 9000 accredited. He cites the example of one part where a small increase in the accuracy of manufacture results in a doubling of the penetration rate of the assembled drill.

Indeed he and his team have carefully assessed all the component parts of the drill and he has a list of tolerances and knows exactly their affect on the finished drill's performance. All those tolerances are achievable but, as with any manufacturing, there is always a trade-off with its cost. Suffice to say that many tolerances are to 5 µm, maximising the performance and efficiency of the drill. As Alan is fond of telling visitors, the internals of the drill can be likened to the high tolerance components of today's automobiles, and look how reliability has been improved in that sector over the last 25 years or so.

Alan explains that the "Peterstow drills contain a minimum number of parts, but they all have to be manufactured to the most demanding specifications. Typically, if a part is more than 5 µm out it would create too much friction within the drill, so it is rejected."

Pneumatic drills wear rapidly and have short lives – not so this drill with its components made to high tolerances. Impala Platinum, for example, has around 14,000 drills, with about 10,000 operating at any none time. Peterstow estimates it could keep those operations running with just 6,000 of its drills. It also estimates that a major new platinum mine using Peterstow drills could cost less than 30% of the capital required for its development as a mine using compressed air drilling.

Cockerill believes the extra productivity offered by these could be used to raise gold output. The labour savings offered could be used to increase output, and he feels it could

make marginal resources payable. He believes it is a "methodology that could arrest the decline of South Africa's gold industry."

In Swaziland I met with Senator Jabulile Mashwama, Swaziland's Minister of Commerce, Trade and Industry who was enthusiastic that the "partnership with Peterstow will help promote Swaziland." She and her team explained some of the benefits that this high technology manufacturing facility was bringing to the country.

Phiwa Ginindza, CEO of the Swaziland Investment Promotion Authority (SIPA), noted: "We very much welcome the Peterstow factory

in our country. The investment is amongst the biggest in Swaziland for five years and amongst the top ten ever. It's great that Peterstow are manufacturing entirely in our country for the export market, creating jobs for 100 engineers and contributing to the high tech economy."

Minister Mashwana also explained how Swaziland plans to use its excellent infrastructure to drive economic growth. Zizwe Vilane, SIPA's Director of Foreign Direct Investment also explained some of the country's plans to revitalise its mining industry. More of that in a future issue. **IM**

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