MINING & CONSTRUCTION

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Atlas Copco

Restoring hope to Japan's 'tsunami coast'

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ON THE COVER

Lead PowerROC drill rig operator Shumei Takahashi of Japan Rock, at the Rikuzantakata restoration project on the east coast of Japan.

PHOTO: Rob Gilhooley.

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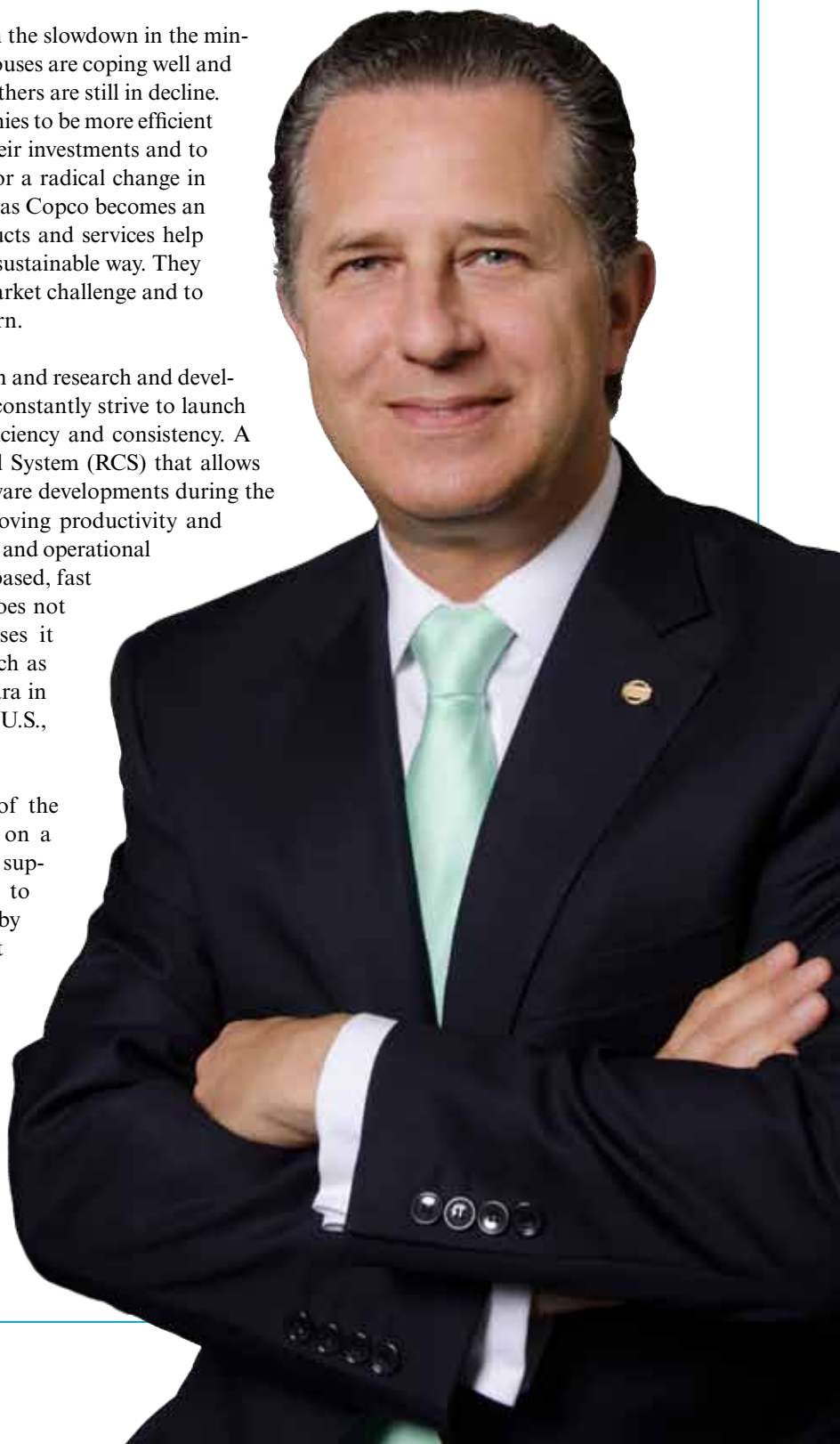
Atlas Copco

Let's take action now!

WE HAVE NOT YET REACHED rock bottom in the slowdown in the mining industry. Some countries or mining houses are coping well and improving their performance, but many others are still in decline. These turbulent waters are forcing companies to be more efficient and productive, to be more prudent in their investments and to cut expenditure. In many cases, it calls for a radical change in "modus operandi" – and this is where Atlas Copco becomes an even more important partner. Our products and services help our customers to be more profitable in a sustainable way. They enable companies to cope with today's market challenge and to maximize profits again in the future upturn.

AT ATLAS COPCO we believe that innovation and research and development always pay off, which is why we constantly strive to launch products that improve the operator's efficiency and consistency. A good example of this is our Rig Control System (RCS) that allows us to add new options, features and software developments during the lifetime of the equipment. Besides improving productivity and cost control, RCS also allows maintenance and operational data to be obtained in real-time for well-based, fast decision-making. However, innovation does not only relate to equipment. In many cases it comes together with service solutions such as those provided to the miners of the Pilbara in Australia and the RigScan service in the U.S., both of which are featured in this issue.

TECHNOLOGY IS the present and future of the mining industry. So instead of relying on a crystal ball to show us the future, I urge suppliers and customers to work together to boost efficiency, productivity and safety by taking the step towards automation. Let today's technology outperform our present experience and demonstrate what it can do to pave the way for profitable, sustainable growth.



JOSÉ SANCHEZ
President
Atlas Copco Drilling Solutions

THE Road to Recovery

Reconstruction brings new hope to Japan's earthquake victims

Entire communities destroyed, many lives lost and tens of thousands of people displaced following a nuclear meltdown. This was the terrible aftermath of the earthquake and tsunami that struck Eastern Japan on March 11, 2011. Today, almost five years on, the region is recovering. M&C reports from one of the many reconstruction sites that are bringing new hope to the survivors.

It was the middle of the afternoon and the rush hour traffic in the small coastal town of Rikuzentakata had not yet begun and the streets were quiet. Some people were on their way to pick up their children from school, others were shopping or planning their evening meals.

Then the buildings began to shake, and within minutes the town fell victim to the worst earthquake in Japanese history.

Measuring 9.0 on the Richter scale, the quake whipped up a furious tsunami and waves some 18 m high swept across the lawns and scenic rice fields, leaving a trail of destruction.

By nightfall, with only a few buildings left standing in the lower coastal areas, the town had virtually disappeared.

Over the next few days and weeks, the facts began to emerge – almost 4 000 homes destroyed, more than 1 700 people dead and thousands made homeless and desperate.

They were not alone. Some 250 km to the south, the eyes of the world watched in horror as engineers fought to save the Fukushima Daiichi Nuclear Power Plant. The attempt failed and a total meltdown, the biggest since Chernobyl, was a reality.

Numerous communities along the coastline suffered that day. But it is Rikuzentakata, in Iwate Prefecture, that has become the symbol of hope and belief in the future thanks to a massive reconstruction program that is now beginning to get results.

Birdseya view: Japan Rock's Site Manager Takashi Sasada with an aerial view of the worksite.

The sound of hope

The muffled thud of rock being blasted is barely audible, but the thin veil of dust that blows in the wind from the Pacific Ocean reveals the location – a hillside above what was once a town and is now a virtual wasteland.

Minutes later, the mechanical sounds of drill rigs and earth moving equipment start up again. Since disaster struck four and a half years ago, the thousands of displaced residents of Rikuzentakata have been living in »

Drilling on high ground: Atlas Copco PowerROC rigs help to provide tonnes of material for the reconstuction of an entire community.

> The main challenge is the sheer quantity of rock that has to be moved every day.

Takashi Sasada Site Manager, Japan Rock Engineering

prefabricated, temporary shelters, with little hope of ever being able to return home. Now, thanks to the reconstruction project, that dream is a very real possibility.

Launched in December 2012 at a cost of USD 1.6 billion, the local authority aims to construct a completely new community on the site, including homes, schools, hospitals, a railway station and a new commercial center. In addition, higher and stronger sea defences will be constructed along the coast – all by 2019.

It is a Herculean task involving an unprecedented amount of drilling, blasting and haulage. More than 90 hectares of land is being elevated by 7–11 m in order to accommodate new houses and the rockfill required for the construction – which is just one of many similar projects in the area – is being extracted from hills in the Imaizumi and Takata districts.

According to Ken Sato, an official of the town's urban development department, an area of around 100 hectares is being leveled, and by the time the operation is complete, more than 12 million m^3 of material will have been excavated.

Major challenge

Drilling and blasting got underway in January 2013, and for the companies involved, it is a mission that tests their emotional strength as well as their technical skills.

The work is being carried out by Happa JV, a joint venture consisting of Japan Rock Engineering and Japan Blasting Technics. Between them, these companies are using a fleet of seven Atlas Copco tophammer drill rigs, all PowerROC T35 and T45 models.

Japan Rock has five of these – four in operation and one in reserve – while another PowerROC is used by its subcontractor Kako and an additional PowerROC is operated by Japan Blasting.

"The main struggle here has been the sheer daily quantity of rock to be moved," explains Takashi Sasada, Japan Rock's Site Manager. "It is considerably more than any regular construction site. During the peak period, the rig fleet was excavating more than 20 000 cubic meters per day."

Sasada adds that securing adequate supplies of explosives for the site is also a constant challenge and that this is being sourced from all over the country.

Japan Rock's fleet has been used in a variety of rebuilding projects up and down the coastline, but none that can compare with the scale of Rikuzentakata.

Sasada said the company chose the PowerROC T35 and T45 rigs for their reliability, high availability and service support.

An artist's impression of what the stricken Japanese town will look like once it has been restored. (Courtesy of the Rikuzentakata municipality).

TREE OF LIFE

The pine forest that stood on the seafront at Rikuzentakata had been there for centuries, majestically swaying in the gentle Pacific Ocean breeze. But when the earthquake and tsunami struck in 2011, it was obliterated – although not entirely.

Out of the 62 000 trees in the forest, incredibly just one remained standing after the tsunami. This solitary, 200 year old tree, has since become known as "The Miracle Pine", a symbol of strength and hope.

The tree had to be removed after it was discovered that the saltwater had ruined its roots, but a restructured version has now been erected on the original spot and will be illuminated every night to commemorate the tsunami victims.

Bridge of Hope

Sasada is not alone among the 16-man Japan Rock crew when he says that he feels the weight of responsibility and expectation on his shoulders. "The pressure is tremendous," he says, simply.

It is easy to see what he means. For example, Futoshi Toba, the town's mayor, has said he has "the highest expectations for the innovative method" being employed.

After each round of drilling and blasting, tonnes of material are transported down to the coastal plains by a 3 km conveyor belt system, designed and built by Shimizu Corp. Reflecting the spirit of this project, the section that crosses the Kesen River is called "kibo no kakehashi," or "Bridge of Hope" by local residents. The 1.8 m wide conveyor belt promises to carry out the haulage operation in the shortest time possible, and the Atlas Copco drill rigs, which have a healthy reputation in the world of Japanese construction, are seen as an integral part of delivering that promise.

Every hour, up to 6 000 tonnes of excavated rock and soil is broken up by jaw crushers before being loaded onto the conveyor. The belt moves at a speed of 15 km per hour with about 5 500 tonnes of material – equal to 550 dump truck loads. The material is deposited at five different stations below, »

then picked up by trucks and hauled to the various sites where the land is being elevated.

Delicate ecosystem

Using this method, it is estimated that the project will take about a quarter of the time it would take using conventional loaders and dump trucks. It also reduces CO_2 emissions by an estimated 4 000 tonnes, while avoiding incidental deposits in the Kesen River which has a rich, but delicate ecosystem.

The work on the highland site involves numerous challenges. While the primary objective is to make room for around 160 homes, a section is also being cleared for the Sanriku Highway, which will pass through the zone.

Drill rig operator Kinya Sekimoto explains: "The number one priority of this project is volume, and with all the different logistics and special considerations we have here it means the process is less systematic than, for example, a dam project."

Nonetheless, according to Sasada and his operators, the rigs have performed very well, despite having barely been out of operation since the drilling began, except for regular maintenance.

United team for a unique assignment: Drill rig operator Mitsukuni Sato (foreground) with Site Manager Koichiro Uchida (second from left) and members of the crew at Japan Blasting Technics Co., on the hillside at Rikuzentakata.

Servicing is carried out by Atlas Copco technician, Yasushi Hikichi, who performs weekly checks on the site and oversees any repair work that may be required.

Due to the hard rock, the average hole depth drilled each day is about 200 m, which is less than originally expected. "The rock is extremely hard here and there's a lot of subterranean water, explains PowerROC operator Shumei Takahashi. "So we have a variety of challenges including the shorter-than-usual life of each drill bit."

Despite this, Site Manager Sasada says his team ensures that the operation goes smoothly and according to plan. "We are starting to reduce drill rig operating hours and there is certainly no need to increase the fleet in order to meet the year-end blasting deadline,"he explains, adding that Japan Rock has been using Atlas Copco rigs for more than 20 years so its operators are very familiar with the equipment.

Sense of pride

Operator Takahashi says he admires the PowerROC rigs' easy handling, while Sekimoto commended their "clear field of vision". The PowerROC T45 is also

Some 6000 tonnes of blasted material is transported to the various worksites by a conveyor belt system, 3 km long and 1.8 m wide.

easy to maintain, especially in comparison with earlier models, he adds.

Takahashi, who was born in a neighboring town and personally experienced the 2011 disaster, admits to have been shocked by the images he saw of the devastated city, which he often visited when he was a young boy.

"I feel a lot of regrets that it has all gone and I sometimes wonder how local residents must feel," he said. However, being able to contribute to the restoration of the town has given him a strong sense of pride. "It's something I can tell the grandchildren," he says.

Sasada concludes: "Japan and the world is watching this jobsite and we cannot delay the time necessary for completion. We are very satisfied with the Atlas Copco machines which have stabilized production in such tough ground conditions."

When the surviving residents are finally able to return to their home and start rebuilding their lives, Japan and the world at large will have reason to celebrate.

Japan Rock's lead PowerROC operator Shumei Takahashi: "This project has given me a sense of pride – something to tell the grandchildren!"

HELPING THE VICTIMS REBUILD THEIR LIVES

Atlas Copco's fleet of PowerROC T35 and PowerROC T45 rigs, is making a major contribution to the reconstruction of the town of Rikuzentakata, thereby helping local residents to rebuild their lives.

The rigs, which are equipped with T51 drill rods, are drilling blastholes on high ground which is now being leveled. The material is used to provide rockfill for land elevations on the coastal plains.

The conditions are undoubtedly tough. The hard, abrasive rock – a kind of Paleozoic conglomerate – has a compressive strength of 300 Mpa. Despite this, each rig manages to achieve up to 200 drillmeters per 7-hour day.

Working on 13 m high benches, the 127 mm (5 in) holes are drilled to a depth of 14 m (13 m with 1 m of subdrill) and at an incline of 80 degrees. The drill pattern consists of a 4 m burden and a spacing of 3.5–4 m.

The fleet's total average production rate is around 1 470 drillmeters per day, which translates to 1.8 million tonnes per month.

This continuous, stable productivity, will enable the 20 million tonnes of material needed per year to elevate the land on the coast to be achieved.

Milestone underground: More than 500 have been delivered worldwide.

Milestone for Boomer S1 D

as 500th rig goes to Macedonia

It's been called The King of Small Drifts – and there are 500 good reasons why. That's the number of Boomer S 1D drill rigs that have been delivered until mid-2015.

Atlas Copco is celebrating the delivery of its 500th Boomer S1 D drill rig. The milestone rig was recently delivered to the Sasa Mine in Macedonia, one of Europe's largest zinc and lead producers.

Since its launch in 2011, the success of this single-boom rig has been impressive in small and narrow drifts up to 31 m^2 in cross section. Highly regarded for its productivity and efficiency, it offers a boom dampening system and a FOPS approved cabin with an interior noise level below 80 dB.

Positive feedback

"Results from the Sasa Mine show that face drilling productivity has increased by 50 percent since the Boomer S1 D was put into operation," says Niklas Berggren, Product Manager at Atlas Copco. "It has a service friendly design which minimizes downtime. We've also had positive feedback on the boom dampening system which reduces uncomfortable bounce and wear during tramming."

Owned and operated by SASA Doo Makedonska Kamenica, the Sasa Mine exports 100 percent of its production and prides itself on keeping high standards for productivity and safety. It has relied on Atlas Copco for cutting edge mining equipment since 1972.

Today, a total of 23 units are at work in the mine including four of the celebrated Boomer S1 D rigs, five Scooptram ST3.5 loaders and two Diamec 232 core drilling rigs. A fifth Boomer S1 D, along with a Scooptram ST7 loader, was also commissioned in the summer, 2015.

Berggren concludes: "Sasa Mine has launched a project to increase production to one million tonnes of zinc and lead ore per year and we are confident that the Boomer S1 D will play an important role in achieving that goal."

New water mist kit

The water mist module mounted on the SmartROC C50 drill rig.

Atlas Copco's highly effective water mist system, which stabilizes the walls of holes during surface drilling, has now been redesigned for even greater efficiency.

The new solution features a hydraulically driven pump mounted directly on a non-pressurized tank, forming a complete module. The advantage of this is better commonality of parts which means fewer parts and easier maintenance.

There are three sizes to choose from – 50, 150 and 400 liters, depending on the rig. For example, the FlexiROC T45, SmartROC T45 and SmartROC C50 rigs all have 400 liter tanks, while SmartROC T35, SmartROC T40, SpeedROC D30 and Rock Buggy all have 150 liter tanks.

FlexiROC D50, D55, D60, D65, C65, T50 and SmartROC D65 already have hydraulic pumps and non-pressurized tanks but will be upgraded with the newly designed tank which will give these models greater water capability. The big news, however, is that it is now possible to obtain two 400 liter tanks on one and the same rig, doubling the water capacity to 800 liters.

The optional system can be mounted on almost all Atlas Copco surface drilling products.

ADJARA HYDRO RACES AHEAD

Engineers working on the new Shuakhevi hydropower plant in Adjara, Georgia, are confident that the project will be completed according to plan – and they have a good reason to be optimistic.

Adjara, officially The Autonomous Republic of Adjara, is an independent enclave of Georgia.

Shuakhevi hydropower plant: Location of the new 185 MW power plant, now being constructed by international joint venture partners.

Essential equipment for continuous loading: The Atlas Copco Häggloader outside the entrance to one of the diversion tunnels.

Daniel Sandström, Product Manager, instructs the team on how to optimize the loading operation.

The Autonomous Republic of Adjara, in the south corner of Georgia, is virtually unknown outside of the region. Next year, however, a new energy project will place it firmly 'on the map'.

Bordered by The Black Sea to the east and Turkey to the south, this small but independent enclave will host the opening of the new Shuakhevi hydro power plant – the largest private investment ever in renewable energy in Georgia.

The project, which will cost an estimated USD 400 million, has been taking shape in the Adjarian highlands since 2013 and has been made possible through an international cooperation.

Funding has been provided by global investors and the company in charge is a joint venture with India's Tata Power and Norway's Clean Energy Invest as majority partners.

Called Adjaristsqali Georgia LLC, the company takes its name from one of three rivers in the highlands that are being used to power the new plant.

The 185 MW Shuakhevi powerhouse will produce 450 gigawatt hours of electricity annually. Georgia says it will reduce greenhouse gas emissions by more than 200 000 tonnes per year and pave the way for regional trade and development.

Shuakhevi is a BOT (Build-Operate-Transfer) project and a run-of-the river scheme, involving the construction of two dams and three diversion tunnels with a total length of about 40 km.

Reason for optimism

Turkish contractor, Age İnşaat ve Ticaret A.Ş. (Age Construction and Trade Inc.) admits that it is a race against time to meet the completion date, but the feeling on the ground is optimistic.

One of the reasons for this, explains Sezai Azizoğlu, the company's Technical Coordinator, is the choice of loading equipment that is enabling the muck from the tunnels to be removed easily and quickly. This is thanks to the company's Atlas Copco Häggloader units that are designed to remove waste rock with their built-in conveyor belts and deposit it directly into dump trucks at the rear.

This method of continuous loading was introduced here about one year ago and is said to have considerably speeded up the whole tunneling process.

"I first saw the Häggloader in an advertisement and I immediately felt that it would solve our problems," says Azizoğlu. "It's a nice machine, simple and effective and faster than the conventional loaders that we were using before.

"According to the specifications, the capacity of the Häggloader is 3.5 cubic meters per minute, but here the operators often reach four cubic meters per minute, which is very good."

Ömer Kuleyinoğlu, Tunneling Works

Overview of the project site: The photo shows the intake tunnel (top center) and the foundations of the main plant facility.

Manager, adds: "We were investigating how to work faster, more effectively and more economically and we decided that the Häggloader could meet all of our needs."

No need for niches

The electrical system means there is no carbon monoxide emission and even when the diesel power system is used, the emissions are substantially less than a conventional loader. In addition, a lot of money is being saved as it is not necessary to create turning niches in the tunnel.

"We have fewer people in the tunnel, the capacities of the loading operation has increased and the whole operation is faster," says Kuleyinoğlu. "So in terms of logistics, these machines have many advantages."

Today, both the Häggloader 7HR-B and the bigger Häggloader 10HR-B are in operation. Project Manager Nazım Kurdoğlu says he was aware of the Häggloader's reputation for efficiency and felt convinced that they would speed up the operation. But he adds that the best results will be achieved if the whole system is designed according to the Häggloader's operating principles.

Ömer Tiryaki, Equipment Superintendent at one of the four construction sites, confirmed that the Häggloader loads twice as fast as the previous loading method, especially in locations where the faces are further from the loading bays. Most of the faces are advanced at the rate of 1.5–2 km per month and more than one third of the tunnels have now been completed.

Engineer Mete Han Erçelik explains that the company made the switch to Häggloader when the distance from some faces to the dumping bays had reached about 4.5 km. "At that point, we knew we had to make some improvements," he said.

Almost 40 blastholes are drilled in the »

> "We were investigating how to work faster and more effectively. Häggloader met all of our needs.
>
> **Ömer Kuleyinoğlu** Tunneling Works Manager, Age İnşaat ve Ticaret A.Ş.

Inside the tunnel: Above, the team discusses the optimum setup in the confined space at the face.

Right, the Häggloader gets ready to start the continuous loading process.

tunnel faces using the V-cut technique but the amount of water coming into the tunnel has been higher than expected. This excess water has been problematic due to the presence of electricity cables inside the tunnel as well as electric discharge pumps.

In spite of this, Erçelik points out that the water conditions have not affected the performance of the Häggloader. Another advantage is a water spraying system which helps to reduce the amount of dust in the air, and less dust also means that it is easier to reposition the drill rig for each new round which saves time.

The Häggloader can be equipped with dual digging arms or a digging bucket. According to Daniel Sandström, Product Manager at Atlas Copco, continuous loading in tunneling projects of this type involving long tunnels is "the best method by far" compared to conventional loaders.

He continues: "There are huge savings to be made through not having to create turning niches, not to mention lower costs for ventilation systems, diesel fuel and wear and tear on tires. In addition, besides being more energy efficient, the Häggloader can be used between shifts to perform other tasks such as scaling."

DEVELOPING GEORGIA'S POTENTIAL

Georgia has some 40 billion kwt/h of hydropower potential in the country of which only 18–20 percent is currently utilized. The Shuakhevi project is a part of a major Georgian strategy to develop this potential.

It is part of a three step scheme which also consists of the 150 MW Koromkheti and 65 MW Khertvisi power plants, and will allow Georgia to use more of its energy resources to meet electricity demands during the winter months.

At the same time, a large proportion of the electricity will be exported to neighboring Turkey.

The project has two dams – the 22 m high Skhalta dam (with a 19.4 hectare reservoir) and the 39 m high Didachara dam (with a 16.9 hectare reservoir) on the rivers Skhalta and Adjaristskali.

Three different types of diversion tunnels are being constructed to divert the water flows to the reservoirs and to the powerhouse turbines. These tunnels are 4.20, 5.20 and 6.20 m in diameter and 5.8, 9.1 and 17.8 km long.

New big hole hammer
CUTS COSTS

The Noche Buena gold mine of Mexico has discovered how to increase the size of its large diameter blastholes without increasing the cost of hammers and bits.

Most surface miners agree that bigger blastholes reduces the cost of blasting but also increases the cost of hammers and bits.

For example, mines have been switching from 152–171 mm (6–6 ¾ in) holes to 215–250 mm (8 ½–9 in) holes to increase productivity. But penetration is slower making big hammers less cost effective over time.

Not any more. Atlas Copco anticipated this trend toward larger holes and has created the new Secoroc COP 86 down-the-hole (DTH) hammer.

Used in conjunction with a solid-shank bit, engineered to make full use of the hammer's power, the COP 86 has proved to be 25–35 percent faster than other hammers in the 215–250 mm range, sometimes as much as 50 percent faster.

Michael White, Research and Development Manager at Atlas Copco Secoroc, says the bit's solid shank makes it not only stronger but eliminates a foot valve failure found in most down-the- hole bits.

Pete Vassar, DTH Product Specialist at Atlas Copco Secoroc, adds that one of the benefits of the COP 86 hammer and bit combination is that such high penetration can be achieved with a variety of Atlas Copco high pressure blasthole drill rigs – DML, DM45, DM30 and Pit Viper. It can even be used on a truck-mounted top head rig such as the Atlas Copco T4W BH.

"This means that customers get to use the rigs they already have on their benches," he says.

Since July 2014 the COP 86 has been achieving good results at the Noche Buena ("Christmas Eve") gold mine in Mexico, owned by Fresnillo PLC.

Used together with Atlas Copco DML drill rigs, the new hammer has consistently helped to increase penetration rates by about 50 percent compared to other tooling previously favored at the mine.

»

Keeping track: Engineer Mariel Marquez is in charge of tracking the drilling operations at Noche Buena.

The right stuff: Guillermo Bernal, Mine Operations Leader, says the new hammer gives him the results he has been looking for.

With the aim to cut drillmeter costs, three hammer and bit combinations have been used with DML rigs whose air packages are rated to 41 m³/min at 24 bar. Running at these air settings would shorten the life of a most DTH setups and give lower penetration rates.

In addition, while a pattern still takes 16.5 hours to complete using the COP 86 hammers, the mine now uses just two rigs instead of four with a total run time of 8.25 hours on each.

Guillermo Bernal, Mine Operations Leader, says: "The dual benefit of increased productivity and long service life are exactly the results I have been looking for."

The COP 86 bits are doing as well as the hammers, further strengthening Noche Buena's confidence in the COP 86's ability to deliver good drilling economy over the long term.

Vassar had the opportunity to witness one of Noche Buena's practical studies in progress at the pit's bottom. Two DML rigs were single-pass drilling 215 mm blastholes to 8 m with 1 m of sub-drill. One rig was equipped with a hammer of another make while the other was using the COP 86 DTH hammer and bit.

"It was a direct head-to-head comparison," said Vassar. "Our COP 86 was drilling 12 to 13 holes to the competitor's eight in the exactly the same conditions on the same pattern."

Faster by minutes

Vassar tracked the time it took each rig to drill the 9-m holes. The competitor's hammer typically finished a hole in five minutes. The COP 86 drillers finished in as few as three minutes and never required more than four. By the time the COP 86 had completed its eighth hole, the non-Atlas Copco hammer was still drilling its fifth.

Vassar averaged his results at the end of his visit. His calculations showed that the COP 86 hammer was 50 percent faster. This conclusion also matched up with figures compiled by Mariel Marquez, the engineer in charge of tracking Noche Buena's drilling operations.

While the comparison study was underway, Noche Buena was not running its drill rigs 24/7. After each 300-hole pattern, the rigs were set aside. Production was limited to meeting the mine's current monthly goal of 244 000 tonnes of ore.

"When holes are expensive to drill," Bernal said, "it doesn't make sense to drill more than you need to. We must be completely confident a more aggressive pace is feasible before ramping up to full capacity production."

The COP 86 bit and hammer combo has already provided clear signs that increased production will be feasible. For instance, previously all four of Noche Buena's DML drill rigs had to run a non-Atlas Copco hammer for 16 hours to drill a 300-hole pattern with a 5.35 m by 6.75 m burden and spacing. They drilled through competent rhyolite, slightly fractured rock.

Bernal added that when Noche Buena's rigs have finished their production pattern they tram over to help a development contractor drill its pattern – as that contractor isn't using the COP 86.

The Secoroc COP 86 weighs 201 kg (443 lbs) which is lighter than previous models making it easier and safer to handle.

The Secoroc COP 86 hammer and friends at Noche Buena: Karina Dominguez, DML operator, with (from left) Juan "Johnny" Cazares, Atlas Copco rock drilling tools technician; Pete Vassar, Atlas Copco Secoroc, Martin Ocano, Atlas Copco sales representative and Cristian Martinez, DML operator.

Two Atlas Copco high pressure DML series rigs complete a 300-hole pattern at the Noche Buena mine: What used to take four DML rigs 16 hours is now done with two DML rigs in the same time using the COP 86 hammer.

Awesome power: The Atlas Copco Robbins 123RH C raiseborer.

WORLD'S BIGGEST RAISE?

Measuring 8 m in diameter and 439 m deep, the new access shaft at Jim Walter Resources' Number 7 coal mine in Alabama, is a major feat of engineering. It is also just possibly a world record in large diameter raiseboring.

It was on December 7, 2014, that Raisebor, a division of Cowin & Company Inc., completed the record raise using its Atlas Copco Robbins 123RH C raiseborer equipped with a multi-modular wing system (MMWS) reaming head.

The task was to provide the mine with a utility and access shaft closer to the working face to increase efficiency. It was taking roughly one hour for workers to reach the face which meant that almost 25 percent of every 8-hour shift was being lost to commuting.

It was Raisebor's third project after acquiring the Atlas Copco machine. The first two were 6 m in diameter so the new project was not only much larger but also more complicated. To start with, a massive concrete foundation, 9.7 m thick, had to be built on the surface, prior to building the platform for the machine to stand on, requiring the removal of 2 500 m³ of material.

> "I see the industry going this way. It's a safety factor that simply makes sense.

Rick Sidwell General Manager of Raisebor, a division of Cowin & Company Inc., USA.

Designing The Moose

Rick Sidwell, General Manager of Raisebor, worked with the Atlas Copco design engineers to develop the huge reamer head. "They respected my input. We discussed what needed to be done to make it better," he says. "We put extra wing cutters where I felt they were required and I appreciated the flexibility that was demonstrated by Atlas Copco."

Called "The Moose", the reamer head was based on the largest existing reamer in the Atlas Copco range. It consists of a 122 cm wide core and two 122 cm wide intermediate wings. Up to eight outer wings extend the cutting diameter to 8 m.

The outer wing design was intended to allow efficient cleaning of the head. It uses 5-row Standard Magnum cutters in pairs with a 2.5 cm spacing. The wings are also designed to be removed to make underground transport easier and can be operated with as few as four wings. Raisebore discovered that six wings was the best option for

American raiseboring specialist Raisebor has set a record in the North American raiseboring industry, completing what is possibly the biggest raise ever bored.

Building the big one: This multi-modular system was used to extend the diameter of the Secoroc reamer. Called "The Moose", the reamer was equipped with 355 mm Atlas Copco Magnum cutters. The Robbins Raiseborer then successfully completed what is probably the biggest raise ever constructed.

keeping the head clear of rock build-up.

Each 355 mm Atlas Copco Secoroc cutter weighs more than 150 kg. Of a total of 50 used during the project, 35 completed the job. Others were replaced because of damage caused by a large chunk of rock that broke away from the face. However, the cutters showed little wear.

Feeling the power

The cutting face was so wide that for each rotation of the inside cutters, the outside cutters rotated 22 times.

Rig operator James Bass said it was the most powerful raiseborer he has ever used. "I could feel more power and better control, and when I made a correction, there was almost an anticipation of my actions," he says. "I could feel the changes in the formation as it happened and change the drilling parameters smoothly and as necessary."

According to Drill Superintendent Willy Hicks the machine performed well throughout the project and he credited the operators who kept an eye on the controls and made the process look easy.

Average advance was 14 cm per hour, but formation changes made boring speed inconsistent. The formation showed a thin layer of coal then sandstone. In a 24-hour period, the raise was advanced 2.5–3 m in two shifts, which was a little ahead of the estimated 1 m per shift or 2 m per day. Throughout the project, the advance was better than projected.

"This is an amazing piece of equipment," Hicks said. "Previously we had to move pipe with a chain hoist. Now we have a modern pipeloader. It grips the pipe up to 138 bar to thread on the connection." This increases user friendliness and safety for the operator.

The formation's high angle fractures with varying changes throughout the formation made it difficult to ream. "Because the head is so wide, I could be pulling through hard and soft formation at the same time," he explained. "Pulling slowly through it, though, I could feel the torque change. The rpm and force showed constantly on the control panel, and I could hear and feel what needed to be adjusted more than I could see it."

The average speed of the head was 2.5 rpm. The average thrust was between 1.6 kN and 3 kN (kilonewton) and the torque was at or below 475 kNm.

Two hydraulic systems

The system operates off two hydraulic systems with the RCS controlling the entire drilling process. An external loop cooling system maintains optimum drive and thrust system temperature. The machine runs on a 480 volt drive pack and a 700 hp hydraulic motor turning the drill string.

Operator Eric Todich agreed with Bass's assessment of the controls, saying, "The reaction with the 123RH C raise drill is quicker, yet it takes time to adjust after the command. This is almost a safety factor." He adds that the control allows for adjustments in the formation so there is no damage to the rig or drillstring. The machine's anti-jamming feature also prevents damage. When rotation pressure moves into the red range on the control panel, feed pressure backs down.

Although the machine is rated for 3–7 m diameter holes, Raisebor's record achievement has now proven that much larger raises are possible. Rick Sidwell concludes: "I see the industry going this way. It's a safety factor that just makes sense."

Raisebor's James Bass operates the Robbins123RH C raiseboring machine from the quiet comfort of its remote operator station.

The new FlexiROC editions enable drillers to use the same equipment for a wide range of applications. From left, the FlexiROC T25 R Construction Edition, FlexiROC T30 R Construction Edition and the FlexiROC T30 R Quarry Edition.

FlexiROC series
gets even more versatile

Three new editions of the FlexiROC range of surface drill rigs have been introduced, each adapted for a wide range of applications in construction and quarrying.

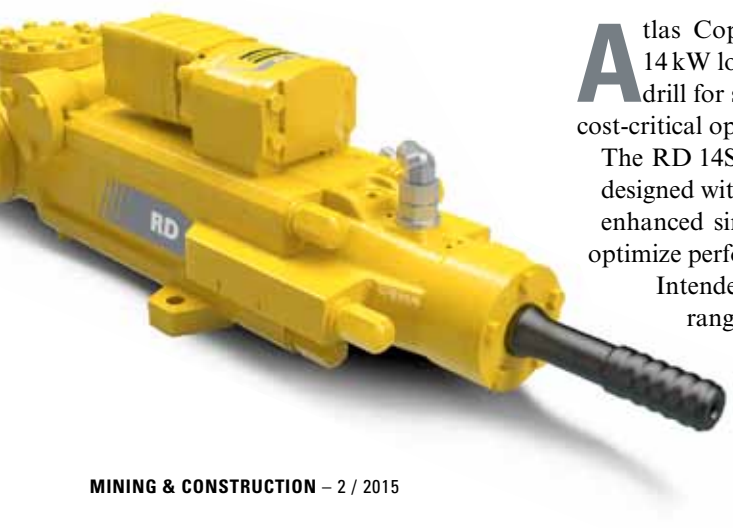
The FlexiROC series of surface drilling equipment from Atlas Copco has a trio of updated rigs in the small and medium-sized hole range. These are FlexiROC T25 R Construction Edition, FlexiROC T30 R Construction Edition and FlexiROC T30 R Quarry Edition.

Designed for challenging ground conditions in the 38–89 mm hole range, the rigs offer a high level of mobility, increased safety, fuel efficiency and extensive reach.

But the most outstanding new feature is that the operator can now view rig data and engine status directly on the RRC (Radio Remote Control) display screen. This makes them ideal for sites with limited access and rough terrain, giving operators the freedom to choose the most convenient and safest working position. In addition, the rigs' COP Logic system automatically adjusts impact and drill feed pressure to optimize drilling performance according to changes in rock conditions.

The extensive boom reach reduces the number of setups which saves time, and thanks to their Tier 4 Final engines with self-adjusting RPM systems, they also meet the latest standards for emissions and minimal diesel consumption.

New rock drill puts consistency first



Atlas Copco has launched a new 14 kW low pressure (145 bar) rock drill for surface drilling in smaller, cost-critical operations.

The RD 14S is the first of a new line designed with two main bodies and an enhanced single dampener system to optimize performance and ease of use.

Intended for drilling in the hole range 64 mm–102 mm, the new rock drill uses T38 and T45 drill rods and air for flushing of the holes. "We are excited to be able to offer this product to a somewhat new category of customers," says Morgan Kanflod, Product Portfolio Manager at Atlas Copco. "The RD 14S is for drillers who prioritize reliability, ease of maintenance and consistent performance over time."

The RD 14S is ideal for mounting on smaller surface drill rigs such as the PowerROC T25DC and for repowering older rigs such as ECM/CM 470. In addition, it will be available to other rig manufacturers.

FOR A GREENER LIFE...

ADD BLUE!

Owners and operators of diesel powered, non-road equipment around the world are now using a special type of fluid to comply with the Tier 4 Final/Stage IV environmental standard. The standard took effect 2014/15 and the implications are all good.

By Johan Haglund, Team Leader, Drive Unit Mechanics, Atlas Copco Surface and Exploration Drilling Division.

Tier 4 Final/Stage IV, the latest international standard for non-road diesel engines is now mandatory in the USA, Canada and the European Union. But what does it mean for the owners and operators of our equipment?

Quite simply, it implies a substantial improvement to our customers' working environment. Tier 4 Final engines reduce PM (particulate matters) and NOx emissions (nitrogen oxides) by more than 90% compared to Tier 3 levels. This means the air at construction and mining worksites will be almost totally free of harmful fumes, and that also benefits nearby communities and society as a whole.

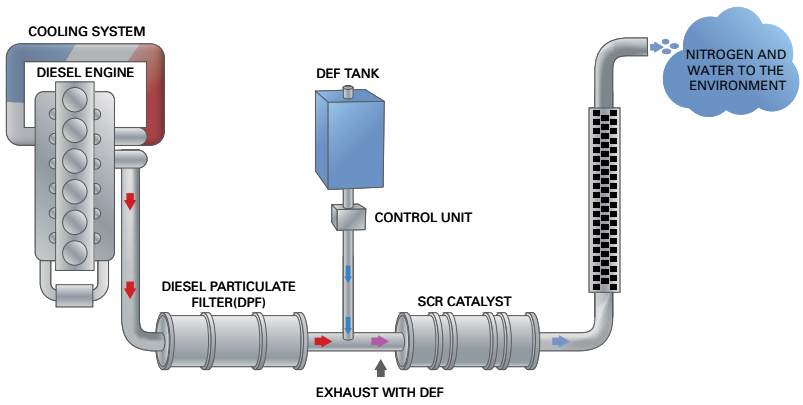


Fig 1. The urea solution (AdBlue) is injected into the exhaust pipe in front of the SCR catalyst, downstream of the engine. Heated in the exhaust, it decomposes into ammonia and CO_2. When the NOx reacts inside the catalyst with the ammonia, the harmful NOx molecules in the exhaust are converted to harmless nitrogen and water.

The first experience

When it comes to drill rigs, the immediate effect of the regulation is experienced at the fueling station. For the first time, operators are required to use two tanks – one for the diesel fuel and one for a special reagent.

This reagent is an aqueous urea solution commonly known as AdBlue or DEF (Diesel Exhaust Fluid). It consists of 32.5% urea, i.e. high-purity carbamide – $CO(NH_2)_2$ – and 67.5% deionized water. It is non-toxic, safe to handle and harmless to the environment. Despite its name, AdBlue is also colorless.

In order to accommodate this additive, we have re-designed our diesel-powered equipment by applying advanced exhaust gas aftertreatment engineering, similar to that required for road vehicles.

The aftertreatment configuration, which was changed between the Tier 3

Fig 2. Examples of the symbols and gauges on the SmartROC display panel that make it easy for the operators to monitor the urea during operation.

and Tier 4 Interim stages, now includes a urea tank and DEF injection system installed between the diesel particulate filter (DPF) and the Selective Catalytic Reduction (SCR) unit *(Fig 1)*. This is now the standard on all Atlas Copco equipment for Tier4/Stage IV countries, for example our FlexiROC and SmartROC drill rigs.

Easing the transition

To help our customers make the transition to Tier 4 Final engines and the benefits it brings, our design team has incorporated a number of helpful features into the new equipment, for example:

- easily identifiable blue colored caps on the urea tanks
- new gauges in the control panels that enable the urea level and aftertreatment to be monitored at all times as well as easy-to-understand symbols to indicate exhaust status and control *(Fig 2)*.

The easily recognizable blue refill cap and hose on the Pit Viper.

The engine aftertreatment systems on our large diameter blasthole rigs such as Pit Viper and DM rigs follow the same principles. As a rule, urea consumption amounts to 2–3% of a rig's diesel consumption but on the Pit Viper the tank is sized to be 5% of the total, so if the rig has a 380-liter diesel tank, it will have a 20-liter urea tank.

A gauge or level indicator shows the percentage of urea remaining in the tank and ISO symbols and lamps indicate potential problems such as high exhaust system temperatures or disabled exhaust cleaning/regeneration.

DEF is not optional!

The urea tank should be refilled every time the rig is refueled. However, operators should make sure that the gauge never drops below the recommended level. If the engine should run out of urea fluid, several warnings will be displayed on the panel before the engine will shut down automatically.

In this context it must be emphasized that the DEF additive is not optional – it is essential. DEF is as important as the diesel fuel and witthout it the engines will simply not operate. Furthermore, DEF quality sensors will prevent water or lesser quality DEF from being used.

Customers who may be unsure of whether their equipment is Tier 4 Final compliant can contact their local Atlas Copco Customer Center. One thing is certain, though. The transition to Tier 4 Final is good news for everyone.

Johan Haglund heads up the drive unit team at Atlas Copco's Surface and Exploration division, engineering T4 compliant surface drill rigs.

THE TRANSFO OF A C

Chile's great Chuquicamata open pit mine is looking ahead to a new and prosperous future – underground.

After more than 100 years of production in what is now the world's largest copper open pit, Chuquicamata is paving the way for a complete transition from surface to underground excavation.

The decision is due to depleting, profitable reserves and the increasing cost of additional waste removal as mining goes deeper. Added to this is the high energy cost of mining and transportation at this giant site which has grown to 5 km long, 3 km wide and 1 km deep.

Instead, Codelco Norte, the state-owned mining company, is going underground where the "red metal" can not only be extracted from the rich orebody at lower cost but will also prolong the life of the Chuquicamata mine to 2060.

The project aims to ramp up to full scale production by 2020 and

RMATION GIANT

development of the undground structure is making good headway.

This first phase involves the construction of four tunnels, two for ventilation, one for access and one for transport. These total 20 km in length and are being driven by contractors Astaldi and Acciona Ossa, both using equipment from Atlas Copco.

For this phase, which started in 2012 and aims to be complete by year-end 2015, Atlas Copco has provided a fleet of Boomer XE3C and Boomer E2C drill rigs, Scooptram ST14 and Scooptram ST1030 LHD loaders as well Minetruck MT6020 trucks.

In addition, Atlas Copco has established a Customer Center branch office in the town of Calama, about half an hour's drive from Chuquicamata, in order to be as close as possible to the site, to provide technical, logistical and service support as well as training for equipment operators.

The second and main phase of the project, which starts in 2016, will involve the construction of no less than 100 km of tunnels and drifts. These will be used for production, material transport, ventilation levels and auxiliary facilities such as crusher stations.

Astaldi and Acciona Ossa say they are therefore well equipped and confident to take on this second phase alongside the two other contractors bidding for the project, Züblin and Geovita.

Astaldi's task

Astaldi's current assignment is divided into three contracts: mine development, ventilation drifts and drifts for access and transport, all of which are on a huge scale.

Changing times in Chile as the world's largest open pit goes underground: From left, (orange vests) members of the Astaldi drilling crew Ales Podgorsek, Massimo Delle Vedove, Domenico Buttafoco and Nicola Colella with Atlas Copco's Rodrigo Escanilla and Bjorn Tisell (yellow vests).

Using its fleet of two Boomer XE3 C, one Boomer E2 C and two Boltec LC bolting rigs, the company is currently developing an access tunnel and a transport tunnel in parallel with 180 m between them.

The access drift has a cross section of 8.7 m wide x 5.9 m high, a gradient of 8% and will ultimately be 7.6 km in length. The transport drift is 9.3 m x 6.2 m, has a gradient of 15% and will be 6.3 km long. In time, this will be equipped with a giant conveyor belt that will carry the excavated ore and waste to the surface.

At the 4.5 km point, the tunnels will also be connected by a 2.5 m diameter escape shaft installed at an inclination of 70 degrees from the horizontal. Average advance in the access tunnel is 272 m per month, while the average advance in the transport drift is 245 m/month. Both 48 mm and 51 mm holes are drilled for blasting and 38 mm holes are used for the installation of rock bolts.

Total commitment

Luca Necchi, Project Director at Astaldi, explains the main reasons for his company's choice of supplier. "When we won the contract for the access tunnels we started a close relationship with Atlas Copco," he says. "We asked them to supply all of the drill rigs, and part of that deal was that Atlas Copco would give us continuous technical assistance in the field, and that's exactly what we received. "However, that's not the only reason we decided to continue working with them in the main tunnels. We also chose them for the high availability of the equipment and the commitment of the Atlas Copco people towards this project, and because of that we work together as a real team."

Necchi also points out that his company works with Atlas Copco in other Latin American countries and is therefore well acquainted with Atlas Copco technology.

"Not all of our operators understand the technology used on the newer rigs so we have them trained, firstly using simulators and then with Atlas Copco experts in the field," he explains. "This field training is very important because well trained operators who know what they are doing are essential for safety. So are the RCS automated systems on the equipment which help to avoid human error and secure a smooth, efficient process."

Necchi says productivity has yielded "very good returns" and adds "equipment availability has been pretty good all along, mostly thanks to planned and preventive maintenance."

> "This is a demanding mega project with no room for disturbances or downtime.

Luca Necchi Project Director, Astaldi

Demanding environment

The work is carried out in a demanding environment with steep inclines and substantial dust and high temperatures, which reduces the life-cycle of the components. Moreover, multiple faces are being excavated in parallel at the same time as the open pit is in full operation which occasionally causes logistical problems.

"This is a complicated, mega project and there's just no room for disturbances or downtime. That's a priority for us," Necchi emphasises. "Atlas Copco helps us to maintain that priority. Hopefully we will win the next phase of the project and Atlas Copco will continue to be our partner."

Acciona Ossa's task

Acciona Ossa is currently developing two of a total of five ventilation drifts. Known as Tunnel 11 and Tunnel 12, these run parallel with 38 m between them. They have a cross section of 10 m x 8 m, a downward gradient of 13.8% and are 4 km in length. They will also be connected by three additional ventilation tubes of 7.75 m x 5.6 m.

Tunnel 11 has been advancing at the rate of 150 m per month and has now reached 1.54 km in length, while the record at one face was 245 m/month. For

In control: Alex Podgorsek, Astaldi´s Equipment Manager, checking out the RCS control system on the Boomer XE3 C.

Left, Bjorn Tisell, Atlas Copco, discussing details of the underground access drift excavation with Astaldi managers.

blasthole drilling, Acciona Ossa is using three Atlas Copco Boomer XE3 C rigs, two of which are in constant use with the third on standby. The rigs are equipped for fully automatic drilling (ABC Total) and are mainly used in the semi-automatic mode (ABC Regular). The blast holes are 48 and 51 mm in diameter.

Drilling time at the faces between blasts is about 1. 45/hr including bolting, which is also performed by the Boomer rigs.

Acciona Ossa's contract has now been extended by 20 months requiring an expansion of its fleet with two-boom Boomer rigs and Scooptram ST1030 LHD loaders.

David Jiménez, Contract Manager at Acciona Ossa, says the main reasons for choosing Atlas Copco was the reliability of the equipment and the continuous introduction of new technologies.

"We had to work on this project for seven months using temporary equipment without navigation systems," he explains. "But when the new Boomer XE3 C rigs arrived it was a big turning point for us. Drilling of the rounds became much more precise and the overall performance improvement was remarkable. We managed to achieve an average productivity of 35 percent more than we had offered, reducing the timeframe for this project by almost one whole year."

Acciona Ossa has also been testing Atlas Copco's mine trucks to determine the most suitable capacity and has chosen the compact 60-tonne Minetruck MT6020.

> "It was a remarkable improvement in performance with our new Boomer rigs.

David Jiménez Contract Manager, Acciona Ossa.

The right truck: Acciona Ossa's Minetruck MT6020 plays a key role in the underground excavation operation at Chuquicamata.

Omar Allel with the Scooptram ST1030 loader: "We are providing a comprehensive and integrated solution."

Onsite training in progress: Acciona Ossa's operator Leonardo Peñafiel (left), receives instruction from Atlas Copco's Rolando Mora (right).

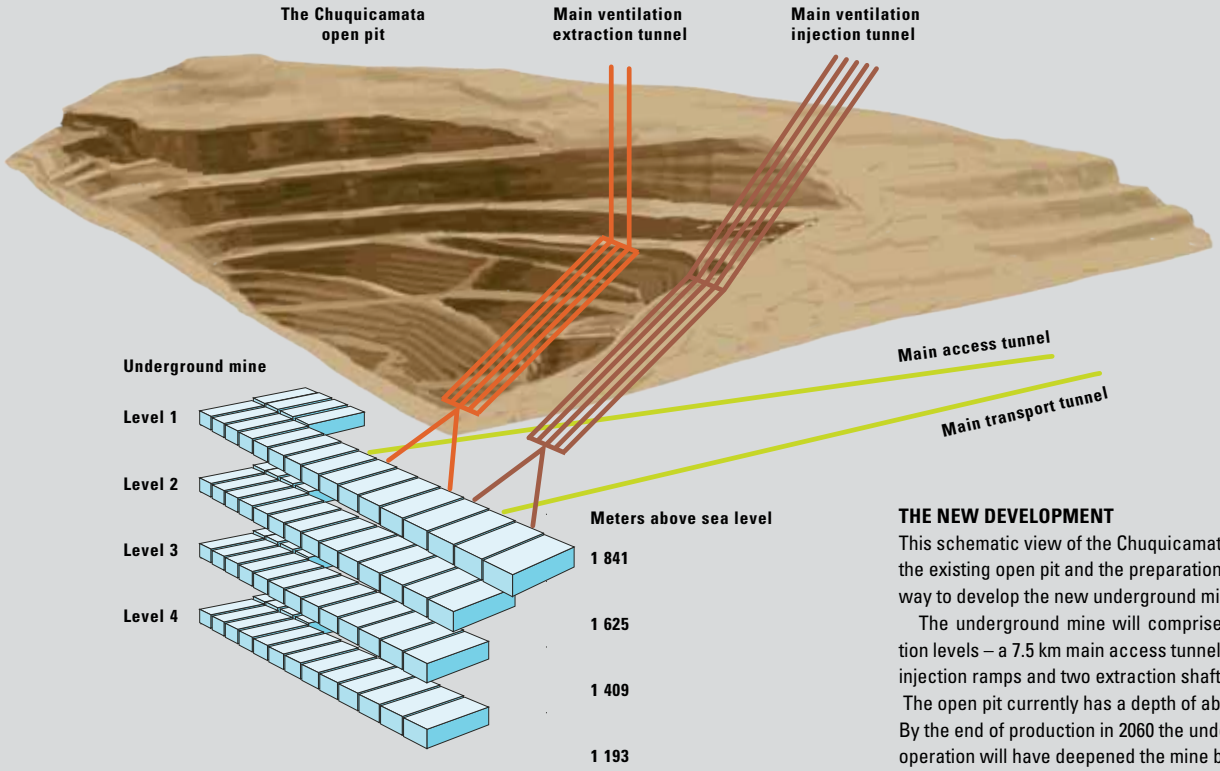
Safety and operator training are clearly priorities for Acciona Ossa, too. "It's part of our DNA," says Jiménez. "Atlas Copco knows how to train the operators and to optimize the team to get the optimum productivity." This is a crucial issue for the project as a whole which will eventually involve some 3 000 workers.

Complete solution

Omar Allel, Atlas Copco's Underground Business Line Manager, says the company is providing a "comprehensive and integrated solution, including everything from supplying equipment and advising on the use of the automated drilling systems, through to service and training.

"More than 50 operators have been trained prior to and during the project at our Competence Center using simulators," he points out. "Besides this, automatic communication with our Distribution Center allows critical parts to reach the teams quickly. We also supply the project on site with hydraulic hoses and rock drilling tools as well as a BQ3 bit grinding machine from Atlas Copco Secoroc.

Rodrigo Escanilla of Atlas Copco, sums it up: "The success factor for our customers has been the interaction, listening to their needs and studying each of the projects together. This has allowed us to design a comprehensive proposal based on recommendation of proper equipment for each application and rock conditions along with fast delivery of spare parts, rock drilling tools and technical support."



THE NEW DEVELOPMENT

This schematic view of the Chuquicamata site, shows the existing open pit and the preparations now under way to develop the new underground mine.

The underground mine will comprise four production levels – a 7.5 km main access tunnel, five clean air injection ramps and two extraction shafts.

The open pit currently has a depth of about 1 100 m. By the end of production in 2060 the underground operation will have deepened the mine by a further 800 m.

THE OREBODY

The underground orebody has been identified as a massive rectangle of approximately 600 000 m^2. This is divided into four macro blocks, 200 to 250 m high. The orebody runs east–west and has a near vertical dip. It is estimated that it contains total reserves of some 420 Mt with a copper grade of 0.71%, of which just 1 700 Mt will be mined over the next 40 years.

To extract the ore underground, Codelco will apply the block caving method of mining. Ramp-up will take nine years after which the mine is expected to have an output of 140 000 tonnes of ore per day. At full capacity in 2020, it is expected to produce 45 Mt/year.

Left, one of Acciona Ossa's Boomer XE3C rigs in action at the tunnel face.

TRAINING IS KEY

Züblin, one of the companies bidding for Phase II of the project, emphasizes the importance of training. Johan Nilsson, General Manager at Züblin International in Chile, says: "We have prepared recruitment and exclusive training for Chuquicamata so that all our selected staff will meet the highest safety standards and technical skills to perform an excellent job. Some of the equipment will be used for the first time in Chile. This means on-site operational and maintenance training with support from Atlas Copco who will provide special facilities such as simulators and qualified instructors."

Insight On CHINA



Over the past decade The People's Republic of China, the world's second largest economy, has experienced unprecedented growth and development. What China does today and in the future affects the world. M&C sat down with **Freddy Man,** General Manager of Atlas Copco's Greater China Customer Center, to get the insider's view.

Q: ***How would you describe the current economic situation in China?***
A: After decades of double-digit growth the economy has slowed down, largely due to over-capacity. However, structural adjustments are being driven by the government in order to put the economy back on a healthy and sustainable development track.

Q: ***Sustainable energy is a big issue. How does China plan to meet its future needs?***
A: In the past, China has relied heavily on coal to meet demands. In recent years it has been developing natural gas including coal-bed methane and shale gas as main energy substitutes. However, due to the complexity of the stratum, the huge water consumption of the extraction process and technology constraints, the total output is far behind plan. In other efforts, the government is promoting clean and green energy to replace fossil energy. We have seen many hydro, nuclear and wind power projects under construction or being approved this year. The long term view is that China's energy supply will be diversified. Coal power will still remain substantial, but with modernized generating systems producing much less CO_2.

Q: ***The environment is a major problem. What is being done to solve it?***
A: To balance high speed growth with minimal damage to the environment is top of the government's agenda. There are many efforts being made including the introduction of stringent requirements on environment protection, heavy fines on those who violate the regulations, continuous improvement of engine emission standards, the replacement of old production facilities which create a lot of pollution with greener solutions, and so on. In the mining and construction sector, dust prevention is one of the key measurements of environmental protection. Dust removal systems are therefore a must for all machinery. With these measures in place together with increased environmental awareness in society we expect a better environment in China going forward.

Q: ***What's the impact of these measures on the manufacturing industry?***
A: Those manufacturers who cannot develop their products to cope with the change of market and customer demand, will be regarded as laggard, and gradually phased out. In contrast, manufacturers who continue to innovate solutions that meet or exceed the new standards at acceptable market price levels will be rewarded with business and growth opportunities.

Q: ***What's the impact of the economic situation on the construction industry?***
A: The pace has definitely slowed down, but the government has put forward many initiatives to boost investment in infrastructure, including railways, highways, power stations, and so on. At the same time, the high priority on environmental protection and safety will push mechanization a step forward. The "One Belt and One Road" policy raised by President Xi Jinping, indicates more potential opportunities in the construction sector and downstream activities in the coming years.

Q: ***And how is the current slowdown affecting the mining sector?***
A: Market demand is weak as a result of low raw materials prices, especially coal, steel and cement. The equipment utilization rate is low while second-hand machines are being actively traded. The lack of cashflow among customers has reduced their affordability which has put high pressure on manufacturers for price cuts and competition in the market is fierce. Mines with better management and cost control have a more competitive edge while others are facing the risk of being suspended or merged. Here, too, the opportunities for development in mechanization continues.

Q: ***How strong is Atlas Copco's market position and brand?***
A: Atlas Copco has always been regarded as a premium brand in China. Even in the current situation we strive very hard to meet our customers' requirements by providing exceptional before and after-sales services, and to deliver good quality products to improve efficiency and production costs. This, in turn, safeguards our strong position in a weak market.

Q: ***Specifically, what are you doing to help customers during this difficult period?***
A: We have increased our product portfolio to meet customer demands in all segments in terms of lowering the total operation cost. In addition, we have expanded our coverage with area

distributors to provide customers with a better and more timely service. Improved maintenance and overhaul services help customers to extend the life cycle of the equipment instead of immediate CAPEX (Capital Expenditure).

Q: ***How do you see the future for mining and construction in China?***

A: I feel sure that these industries will not repeat the fast growth they have experienced in the past, at least not for the next 10 years. However, a higher level of mechanization can be foreseen for both sectors with the government attaching more importance to safety and environmental protection. Over-capacity will be under control while the industries will be evolving into a healthy and steady growth pattern. Quality, rather than price, will be the top consideration when customers make a purchase decision.

A HELPING HAND

With metal prices lower than for many years, the mining industry is facing major challenges. The Pilbara region is no exception where the miners are turning to service solutions as a way to combat the downtrend.

The Pilbara region in the North of Western Australia is a showcase of modern mining. This vast and remote corner of the world, covering an astonishing 500 000 km² has been fielding its minerals – notably iron, gold and copper – on a large scale since the 1960s. Some of the giants of the industry are well established here, among them Rio Tinto and BHP Billiton, which, together with local mining companies and contractors, contribute much to the Australian economy using some of the industry's most sophisticated equipment and methods.

These days, however, like many other mining regions around the world, the normally hot and dry Pilbara is feeling the cold pinch of lower metal prices and weaker global demand.

> Close cooperation with customers ensures minimum equipment downtime.

Dale Waters National Marketing Manager, Atlas Copco Service Australia.

IN THE PILBARA

The Pilbara mining region in Western Australia: A huge, remote area, roughly the size of Spain, with vast mineral resources.

Harsh environment: The Pilbara is tough on the equipment and requires innovative service solutions to minimize downtime.

The challenges in adjusting to this new market situation are considerable, and here, as practically everywhere, the focus is on cost reduction. One of the ways that companies are tackling this is to minimize the time that mining equipment is out of action.

In this respect, one of the major suppliers to the companies of the Pilbara, Atlas Copco, is playing a key role with proactive service solutions for the many different types of Atlas Copco rigs at work in the region.

One example of this is a service exchange package which involves a Component Repair Menu that allows customers to continue mining with minimal downtime. Tailored to suit the needs of today's tight operational demands, customers are able to choose from the following options:

- **REMAN:** Components ready off the shelf, rebuilt to an 'as new or better' standard, complete with a comprehensive warranty and a 'Core Credit' on the return of the used item.
- **DO & CHARGE:** Rotable components that are owned by the customer and returned to an Atlas Copco workshop to be stripped, inspected and repaired (customers receive detailed analysis and reporting on identified failed parts) and Atlas Copco alerts the customer if the item is economically repairable and specifies the repair costs.
- **SERVICE EXCHANGE:** Components that are returned to an Atlas Copco workshop, stripped and inspected with customers paying the cost of repair plus a fee for the interim use of a 'stand in' Atlas Copco exchange component.
- **SERVICE MODULES:** Customers receive a modularized component, typically complete powertrains, powerheads, airends and the like, designed to be 'Plug & Play'. The component arrives in an engineer designed, transport friendly, protective steel container, fully dressed with all accessories (e.g. hoses, connections, fastenings etc) to facilitate speedy

AT THE FOREFRONT

Atlas Copco is a long-time supplier to the companies at work in the Pilbara and is also at the forefront of the automation revolution, providing computer-age tools that make the extraction of ore faster, more efficient, but above all, safer.

Today's equipment offers precision drilling that goes far beyond the skills of even the most experienced driller, giving information on ground conditions that previously required days to obtain.

These efficiencies are having a positive impact in the Pilbara. As an example, Adrian Boeing, Automation Manager at Atlas Copco, refers to autonomous drilling technology that enables a single operator to supervise a fleet of drill rigs.

He points out that BHP Billiton Iron Ore reports that these benefits have resulted in an increase of 9.8% in meters drilled per shift and a 22% improvement in drill bit life.

Apart from the obvious savings in labor costs, there is much greater utilization of equipment by allowing a drill to operate during meal breaks, shift changes, meetings and other events that traditionally would result in lost production.

Another factor is improved drilling consistency resulting from more accurate data about ground and drilling conditions, leading to higher productivity.

All this is invaluable at a time when the iron ore industry is focused on reducing costs whilst increasing production, a strong factor in the growth in demand for automation technology. The next areas to be targeted are automation systems covering a number of sites, long distance remote operation for example, between the Pilbara and Perth.

Boeing points out that Atlas Copco is continuously upgrading the automation portfolio with incremental improvements and new features. This includes introducing new drill rig models, such as the next generation top-hammer SmartROC T45, and the larger Pit Viper 316 drill.

Chris Clewes, Regional Manager in the Pilbara for Atlas Copco, says: "The growth in the new generation equipment primarily occurred with drilling contractors buying DML, SmartRig ROC F9 and SmartROC D65 rigs and then, about three years ago, with the introduction of the Pit Viper 270 to the major mining companies.

A familiar sight in the Pilbara: Atlas Copco's Pit Viper 271 drill rigs.

installation, minimal downtime and early return to work of the machine.

Complementing the portfolio, all repairs include the use of genuine Atlas Copco parts and are backed by the Atlas Copco service warranty.

Close cooperation

In addition to this, Atlas Copco uses advanced software to track the life cycle of all key components and parts enabling it to predict when replacement parts will be needed. Parts that need to be replaced more often, and essential parts critical to operations, are held at Atlas Copco branches throughout Australia, while those replaced less often are held at distribution centers in Perth and Sydney.

Another key aspect of the program is Custom Engineered Solutions, through the plug and play principle. This is designed to reduce the cost of parts in maintaining a machine and the labor needed.

Dale Waters, National Marketing Manager for Atlas Copco in Australia, explains that a pre-assembled component is cheaper and more efficient to supply and install than trying to buy the individual parts for assembling and fitting on site.

Custom engineered conversion kits are also invaluable, for example, when equipment requirements change after a move to a new location.

Common conversions include bolting units, rod size, production drilling units, automation and power pack conversions. The kits ensure that machines are quickly brought back into service after a component upgrade.

Waters adds that the system relies on close cooperation with customers to ensure that downtime is kept to a minimum.

"The PV-270 series became the "drill of choice", going from two to 59 rigs in four years." He says the Pit Viper has become legendary in the industry with the most recent generation providing awesome power and precision.

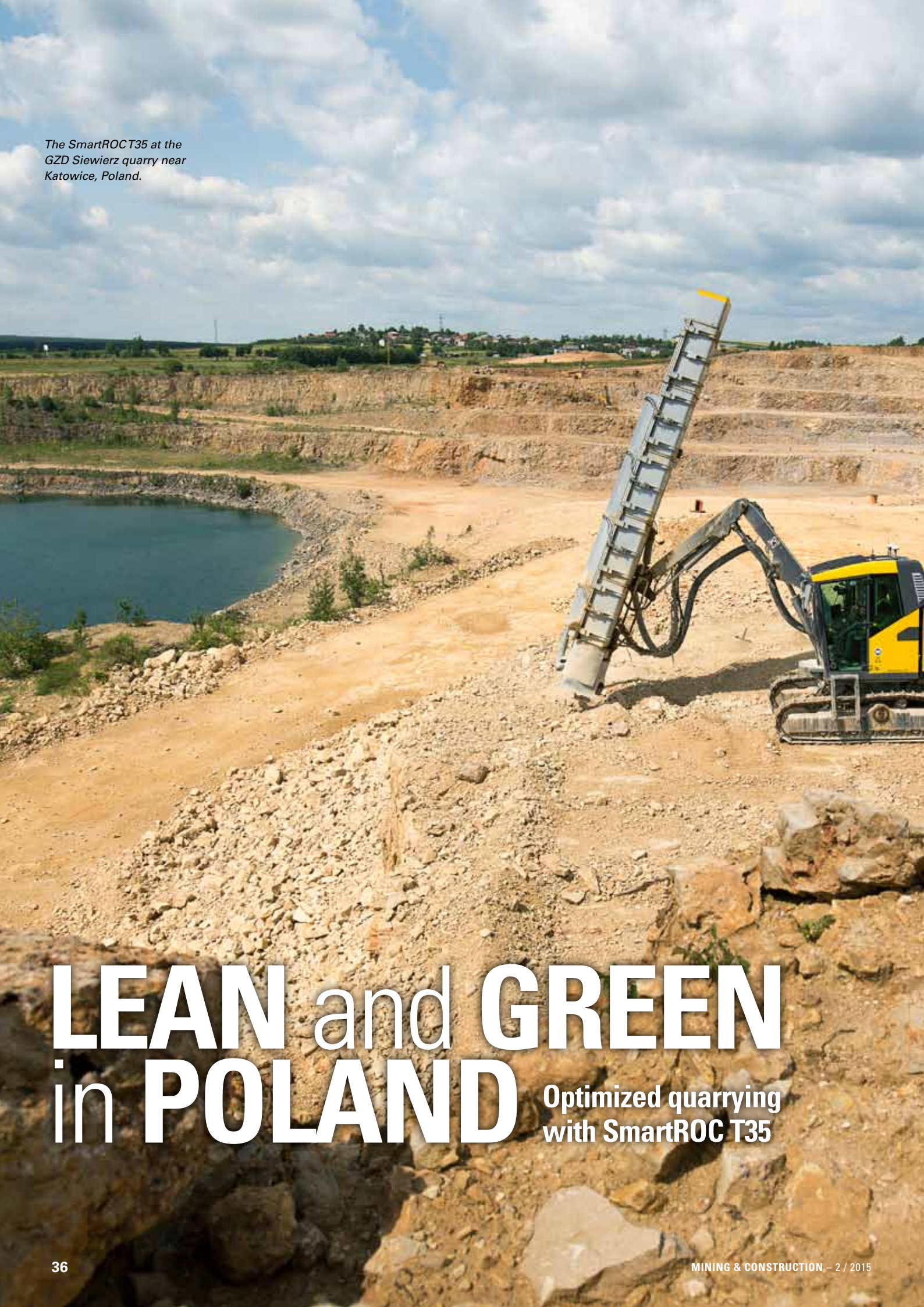
In a project to ensure that these machines would be perfectly adapted to Australian conditions, engineers and operators from the Pilbara went to the Atlas Copco plant in the U.S. and specialists from the plant travelled to Perth. Dustin Penn, Business Line Manager, Australia, says the resulting modifications were well accepted in the Pilbara.

Atlas Copco took the preparations a step further by installing simulators in Perth to train local operators. It was a significant transformation, from equipment in which hydraulics or electrical elements were the key components, to those in which computers took over. Staff from BHP Billiton, Rio Tinto and contractors went through a three-day Master Driller course on the simulators, followed by more training on site.

Dustin Penn said the advanced automation introduced by Atlas Copco was particularly important in the Pilbara region because of the higher costs of mining in remote regions. "We continue to work with our clients to increase efficiency and reduce costs as the iron ore industry faces difficult times," he concludes.

> "The PV-270 series became the "drill of choice" and is now legendary in the region.

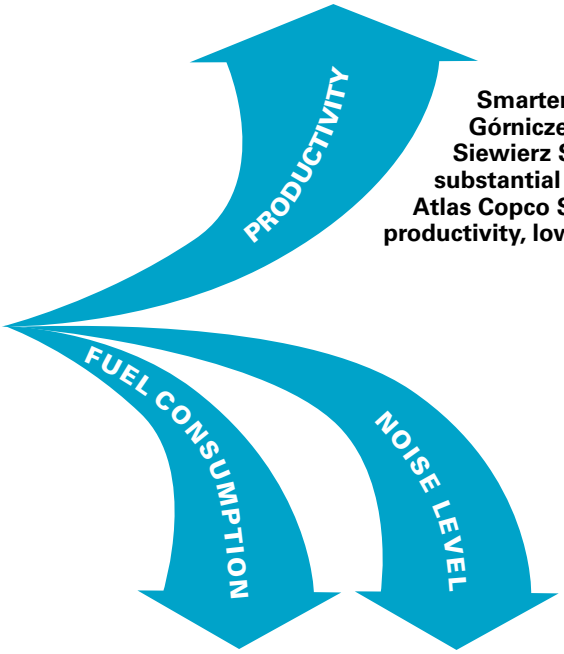
Chris Clewes Atlas Copco's Regional Manager for the Pilbara.



The SmartROC T35 at the GZD Siewierz quarry near Katowice, Poland.

LEAN and GREEN in POLAND

Optimized quarrying with SmartROC T35



Smarter all-round: Quarry company Górnicze Zakłady Dolomitowe Siewierz S.A., has gained three substantial benefits since introducing the Atlas Copco SmartROC T35 drill rig: increased productivity, lower fuel costs and less noise.

The GZD Siewierz quarry in southern Poland is gearing up for leaner production with a SmartROC T35 that has cut noise levels and energy consumption by half.

The dolomite quarries of the Brudzowice mining area keep Poland's wheels of industry turning. They feed the construction sector with road base and aggregate, supply agriculture and fertilizer material and provide flux for iron and steel smelting.

Dolomite, which is classified as both a mineral and a rock, is excavated in the south of the country where many copper and coal mines are also located.

Here, some 35 km from the town of Katowice in southern Poland, an Atlas Copco SmartROC T35 has been put into operation at the GZD Siewierz quarry. It is on a mission to boost productivity in blasthole drilling, lower the cost of extraction and improve the operators' working environment.

"We introduced the SmartROC T35 because we needed to make savings in our drilling operations. Compared with our older equipment we can reduce running costs by 50 percent," says, Zbigniew Tomsia, President of Górnicze Zakłady Dolomitowe S.A., which owns and runs the quarry. He continues: "The SmartROC T35 has been tailored to our needs. It has modern solutions including a silencing kit which was important for us in order to improve working comfort."

The GZD Siewierz quarry has a yearly output that varies from one million up to 1.9 million tonnes. The production capacity can reach 2.5 million tonnes if demand is high. The quarry features six excavation levels with various dolomite types at each level.

Environmental financing

A key factor in the company's decision to upgrade the fleet and invest in "state-of-the-art equipment", as Tomsia describes it, was the possibility to obtain financing for energy efficient equipment. "We were able to demonstrate to our bank that »

> "The silencing kit was important for us in order to improve working comfort.

Zbigniew Tomsia President of Górnicze Zakłady Dolomitowe.

Hands on: Operator Marek Borówka (below) praised the rig's comfort, ergonomy and technology.

Meeting the challenge: The SmartROC T35 was delivered to the GZD Siewierz quarry with a silencing kit and dust collector system. (Above, right) Marcin Płachta, Product Manager at Atlas Copco, discusses the benefits with operator Marek Borówka.

» a minimum of 20 percent energy savings could be made by introducing the SmartROC T35, which benefits the environment," he says. "The operation-per-meter ratio is phenomenal. We achieve a fuel consumption of 0.38 litres per meter drilled, or 12.89 liters per hour." This is equal to a 50% reduction in fuel costs.

"Another advantage is the online machine monitoring," he adds. "We can carry out a full analysis and read out how many holes have been drilled on any given day, how long the drill rig has been in operation, the distance it has covered and the engine hours.

"Due to the environment we have also had a new dust collector system installed on the drill rig," adds Tomsia. The company has a long-standing relationship with Atlas Copco dating back to 1997 when the first ROC D7 drill rig was purchased.

The newly introduced, SmartROC T35 features automatic feed alignment and rod handling systems as well as GPS. It is equipped with 45 mm drill rods and 76 mm drill bits. The rig achieves a penetration rate of 1.52 m per minute on benches 10–14 m high with a burden and spacing of 2 m x 2.5 m.

Low noise, high comfort

Before purchase of the SmartROC T35, operator Ireneusz Borówka visited a quarry in the Czech Republic to evaluate the drill rig's performance and comfort.

"There's a lot of space in the cabin and the two multi-purpose joysticks are very useful," explains his shift partner and second operator, Marek Borówka. "Every button is multifunctional which means I can use the same joystick to add drill rods while drilling and then switch to control actuators.

"The air conditioning system also does the job and is highly efficient when the ambient temperature is high and the air is moist, preventing the rig windows from fogging up. In addition, the silencing kit has reduced noise by 50 percent and makes the drill rig comfortable to work with. Now we can actually hold a conversation when standing nearby."

While 60–70 percent of the quarry's dolomite becomes aggregate for the construction of roads and buildings, Tomsia emphasizes the challenge of seasonal demand. The quarry is currently supplying more dolomite to chemical plants and manufacturing fertilizers and this winter expects to be supplying the steel industry.

"This means that flexible, low-cost production is essential," he says, "and this is why it is important to increase efficiency. The new SmartROC T35 is helping us to achieve that goal."

Górnicze Zakłady Dolomitowe S.A, in Siewierz, Poland, has been using Atlas Copco equipment since 1997. The current equipment fleet includes three drill rigs: the FlexiROC T35 (formerly ROC D7), a ROC F7 (similar to today´s FlexiROC T40) and the recently acquired Atlas Copco SmartROC T35, which is serviced and maintained by the ROC CARE and COP CARE total service package.

The new Diamec Smart: A new control system optimizes performance and extends the life of consumables.

New horizons for safety

Diamec SMART series brings automation to core drilling

Rough, tough and hazardous tasks in drilling are diminishing as technology marches on. The newcomer Diamec Smart is a good example of today's safety innovations.

Changing inner tubes that often weigh around 100 kg with core samples using manual labor has become a thing of the past. A new series in Atlas Copco's core drilling range called Diamec Smart has been launched and is proving a triumph for underground safety.

Loaded with automatic functions, the Diamec Smart makes the complex task of core drilling considerably safer and more ergonomic.

Diamec Smart is pioneering advancements with automated rod handling and a new, improved Rig Control System (RCS) that enables optimized performance and dramatically extends the service life of consumables.

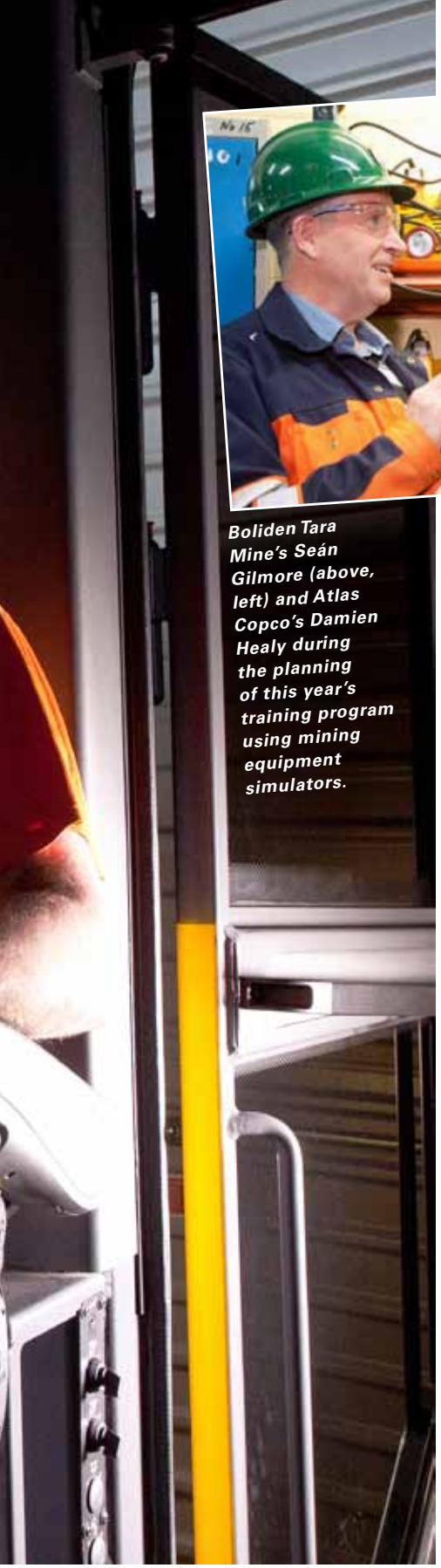
"Customers who have tried automatic drilling and rod handling never want to go back. The Diamec Smart series sets a new standard for underground core drilling," says Martin Sommers, Vice President Marketing, Exploration Equipment, Atlas Copco.

Adding and removing drill rods automatically has also eliminated operator fatigue. This, in turn, helps to keep the pace during an entire shift and is destined to give a boost to productivity.

For more information on the new Diamec Smart series and the improved Rig Control System, scan the QR code above or visit the Atlas Copco YouTube channel.

Work smarter, improve continuously, enhance skills…

TARA MINES' ROAD



Boliden Tara Mine's Seán Gilmore (above, left) and Atlas Copco's Damien Healy during the planning of this year's training program using mining equipment simulators.

MAP FOR SUCCESS

Boliden Tara Mines is in no doubt about the positive impact that systematic training of equipment operators and maintenance personnel can have on efficiency. So much so, that it has made training a fundamental element of its business strategy.

Boliden Tara Mines in Navan, Ireland, has been producing lead and zinc for almost 40 years, and in recent times has experienced many of the classic challenges of an older, deepening underground mine.

Realizing that it needed to adapt its operations to address these challenges, the management team made two major strategic decisions.

The first step was to restructure the organization towards a 'one mine concept', instead of the previous three-area concept, each with its own self-contained mining teams. The second was to step up its personnel training program in order to enhance skills, work smarter and establish a climate of continuous improvement.

Atlas Copco, which supplies Boliden Tara Mines with mining equipment, was also chosen to be the mine's partner in training development.

Mike Lowther, Manager of Mining, says the new direction was essential in order to maximize efficiency and flexibility. "The deeper we go into the mine, the tougher the logistics get," he says. "We can't do anything about exchange rates, metal prices or orebody grades but we do have the ability to control the efficiencies of our mining and our costs. Mineralisation is only ore if you can mine it profitably – to turn it into ore, the mine has to be economically viable."

Cross-skilling in focus

Over the years, the mine management has stressed the importance of enhancing skills and has worked closely with the local mining unions to achieve this. This work has now moved into a more intensive phase as an increasing pool of cross-skilled operators and maintenance staff pass through the Atlas Copco Drill Rig Simulator Training Program.

Cross-skilling focuses on training the miners to operate groups of machines with similar functionality, such as Atlas Copco's underground production drilling and bolting rigs.

The first training program took place in 2013 and was an immediate success. »

The second was held earlier this year, and here too, the results appear to be having an even stronger impact on operations.

In preparation for the 2015 course, the mine and Atlas Copco formed a strong project team led by Seán Gilmore, Training Coordinator at Boliden Tara Mines, supported by Damien Healy, Atlas Copco's Service Manager in Ireland.

Gilmore took on the instrumental role of Simulator Training Planner, making sure that all the preparations were in place prior to the delivery of the simulator. Strong backup was also received from the mine's electrical and IT sections.

With just four weeks from go-ahead to implementation, it proved an intensive process. All trainees had to be registered with the simulator training software and system, email training accounts had to be set up, the surface training area had to be upgraded and, most importantly, the schedule had to be coordinated with the mine's shift pattern. In addition, the schedule had to be adjusted around the trainees' holidays and shift rotas to achieve the target of 24 craftsmen and 24 drill rig operators to be trained and cross-skilled. A total of 56 trainees took part, an increase from 32 in 2013.

Once the schedule was in place, Mike Hall, normally Shift Boss at the mine, was appointed NPIC (Nominated Person in Control) for the 2015 project. Hall's role was to ensure risk assessments were completed for the preparation and installation of the simulator on site, communication of the schedule to each trainee, and liaising with the Atlas Copco trainer.

The program included both computer-based introductory training as well as operator training on the simulator, depending on the skill level of the trainee.

Trainees with broad experience of the drill rig machine group used the opportunity to fine tune their skills, while operators in the early stages of cross-skilling gained an understanding of the functioning of the rigs in the computer programs.

The computer-based training covered the following five modules, each with ten categories:

- Underground Drilling
- Rock Mechanics
- In the Hole Drilling
- Rock Drilling Tools
- Maintenance and overhauling

A pass rate of 80 percent is required at each stage to progress through the

> Simulator training is an important way forward for increased efficiency in the modern mining industry.

Mike Lowther Manager of Mining, Boliden Tara Mines.

Personal trainer: Trainees are instructed at every level on how to perform drilling procedures in the simulator with no impact on the mine's actual operations.

Room with a view: Simulated production drilling with a Simba drill rig.

training levels. The trainees spent three to four hours studying topics such as voids, cracks, rock hardness and more, as well as common issues related to rock mechanics, rotation feed and impact.

They also learned how guages react to changing rock mechanics and, in turn, the stress impact on the equipment. As one operator commented: "Seeing the basics of rock drilling tools, along with why and when the different drills are used, was interesting and relevant."

Replicating reality

With all the original components and controls in the cab, the simulator perfectly replicates a mine and the Boomer, Simba and Boltec rigs while offering a variety of scenarios that increase in complexity, from safety and start-up procedures to advanced performance.

At each stage, the trainees were instructed on how to carry out the actions required. Mike Hall points out: "After each trainee passes the training program, a printed report is added to their training records as part of the internal licensing process we have in place."

The efficiency saving for the mine is highlighted by Gilmore and Hall's belief that if an operator who is not familiar with mining equipment were to spend two days on the simulator training program, the time spent is the equivalent of three to four weeks 'buddy training' underground on a real machine.

While the mine is not able to change the fact that it is aging and deepening, its determination to change the way it works through restructuring and its choice of innovative training methods, has led to clear efficiency gains.

Mike Lowther concludes: "The reorganization process proves that the more efficiently and cost-effectively you can do things, the more marginal mineralization can be mined, thereby adding to the potential to extend the life of the mine.

"Training is an important part of our focus on decreasing operating costs and Atlas Copco's Simulator Training Program continues to form part of Boliden Tara Mines' plans for the future."

TARA MINES – largest in Europe

Boliden Tara Mines, is the largest underground zinc and lead mine in Europe and the fifth largest in the world. Owned by the Nordic group New Boliden in Sweden, it is located at Navan, County Meath, approximately 50 km northwest of Dublin, Ireland.

The mine was discovered in 1970 and opened in 1977. It was acquired by Outokumpu in 1986 and transferred to New Boliden in 2004 as part of an asset exchange between the two Nordic companies.

Placed on care-and-maintenance in 2001 on account of high production costs, the mine was restarted in 2003 and produced 2.55 Mt of ore, the highest tonnage since 1995.

Some of the output is delivered to Boliden's Odda and Kokkola zinc refineries, both formerly owned by Outokumpu, and the remainder goes to European customers.

Boliden AB is currently one of the leading mining and smelting companies in the world with operations in Sweden, Finland, Norway and Ireland. After discovery, an extensive drilling program indicated an orebody of almost 70 million tonnes at a grade of 10.1% zinc and 2.6% lead.

When business slows down, drilling contractors may have to lay-up some of their equipment. But when things pick up again, the equipment may no longer be "fit and ready" to take on new assignments. Here's the best way to find out.

BACK TO WORK

with the help of RigScan technology

Mining contractor Small Mine Development of Battle Mountain, Nevada, USA, prefers to hold on to its drilling equipment rather than sell it when business is slow. This way, the company does not have to source new rigs when the work suddenly returns.

In this respect, SMD is typical of many similar companies around the world. As Mike Schomer, SMD's Maintenance Superintendent, puts it: "You can't bid for jobs with equipment you don't have."

Unknown factors

Two of the company's Atlas Copco Boltec rock bolting rigs are a case in point. They had recently been standing idle on the surface, one of them for almost two years, after working 24/7 underground.

But what repairs and maintenance did these rigs need at the time they were sidelined? How far had their performance fallen in relation to the manufacturer's specification? And what had exposure to the Nevada summer sun and a severe winter done to their hoses, electrical components, mandatory safety labels and signage?

"If we had invested in bringing the rigs back to specification right away," explains Schomer, "we would have allotted a good portion of our capital indefinitely to idle inventory. But we knew the industry would pick up again, so we were looking for the fastest way to get the rigs back into service condition as soon as potential new contracts appeared again."

The solution was a thorough audit of the rigs using RigScan technology. Schomer says: "The RigScan audit helps us get assets we already own to go back into service so much faster than waiting on a new rig delivery or sourcing a different one for remanufacture."

The audit was carried out by the Atlas Copco facility in Elko where Matt Roemmich, Underground Product Support Technician, explains: "The audit gives the customer a thorough OEM inspection. It identifies everything and will label each item as a critical safety or performance issue or a regulatory concern, all the way down to cosmetic items. That helps the customer prioritize what they want done and create an exact budget for the project."

> "RigScan helps us get assets back into service much faster than a new delivery.

Mike Schomer Maintenance Superintendent, Small Mine Development

Schomer was so impressed with the first inspection that he ordered a second RigScan audit to be conducted in the SMD yard. The inspection is only the first step of an audit. Roemmich says: "I take that rig-specific inspection list back to the office to match failed items against the rig's parts manual. Some just require an adjustment, others require replacement parts or service kits. I'll try to find economical choices for the customer to look at in addition to new parts from the Atlas Copco exchange program, for example.

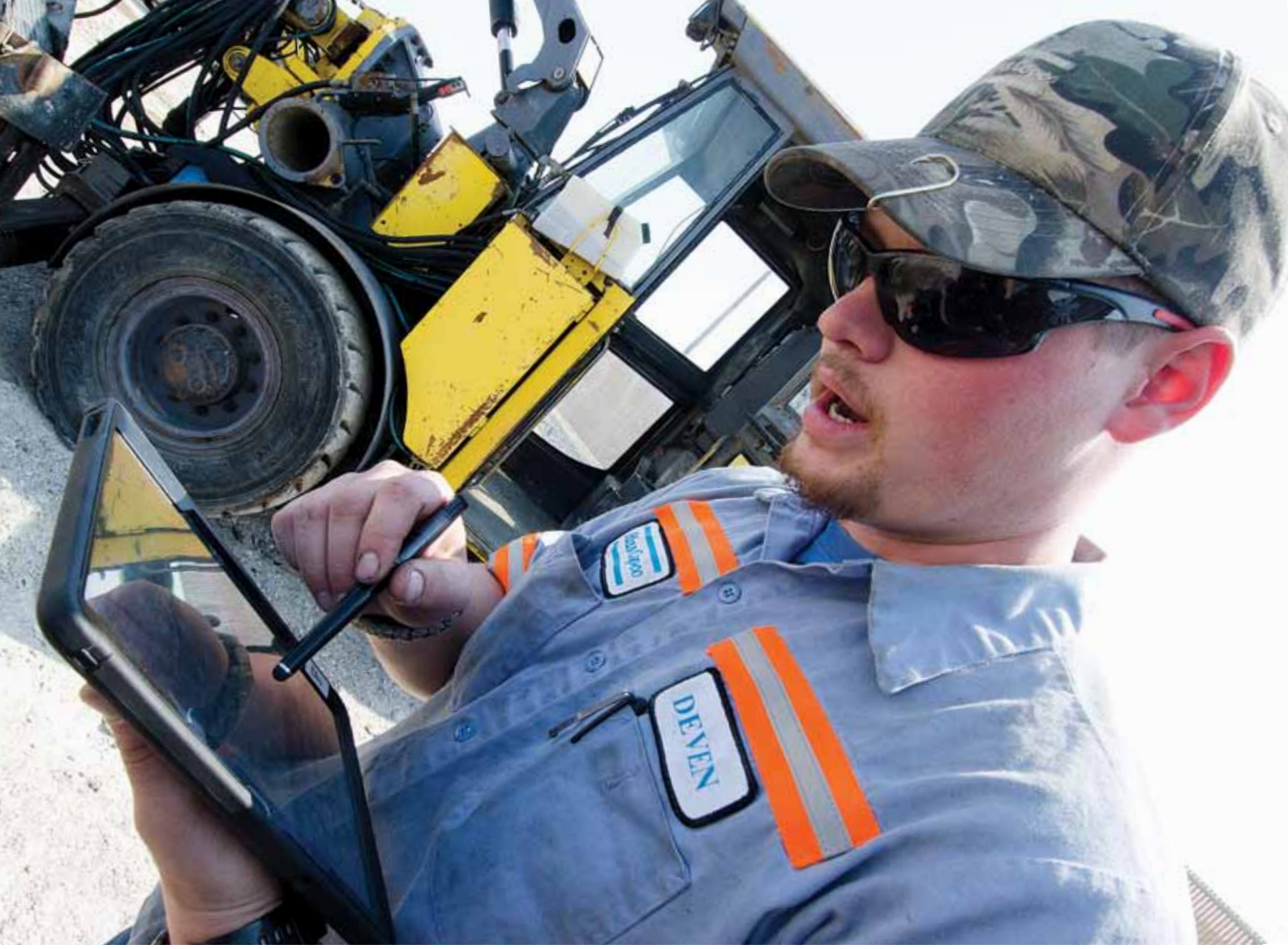
"The customer can get a RigScan discount if they buy parts from us or contract us to do the labor, but they have the part number and can source the parts themselves if they choose."

Multiple inspection points

The RigScan audit for SMD's second Boltec, a 2007 model, consisted of 251 inspection points.

Schomer said. "My service staff is busy. To do an inspection as thoroughly as Atlas Copco's technician did I would have had to pull my staff off other duties to comb that rig for days. Then we'd have to research part numbers and source them. Although I'm confident they would have caught many of those same critical issues, they couldn't have gotten them all."

Roemmich explained why even the best technicians won't catch every point. "SMD's technicians are great at what they do, but most of their day-in/day-out attention is on performance," he says. "They keep those rigs working.



A RigScan audit in progress: Atlas Copco Field Service Technician Devon Jantzen points out that the audit will not allow an auditor to skip an item. Each item must be completed in full before the program will allow him to move on to the next one.

SMD's technicians would definitely have caught a lot of these items. But would they know that a mandated safety label or informational label was missing? If a rig has to be taken out of service until a label is replaced, that's unscheduled downtime."

Schomer adds: "If you ask me what the financial incentive is for doing this it's that I can establish a precise budget. Obviously, I want all the critical safety and important performance issues done. But I can choose which items to address in addition to those and stay within a budget that we set."

Roemmich has performed RigScan audits for Boltec rigs, Boomer face drilling rigs, Minetruck haulers and Scooptram LHDs. He concludes: "I see great benefit for mines and contractors that periodically schedule RigScan audits. RigScan is basically a great tool that helps to support the product from cradle to grave."

The SMD RigScan audit was performed by Atlas Copco Field Service Techician Deven Jantzen and Matt Roemmich, Underground Product Support Technician at Atlas Copco in Elko.

The Boltec showed 8,137 hours of run time. Roemmich believed it had turned over at least once, representing closer to 18,137 hours. Jantzen began following the checklist of 251 items for this specific Boltec model.

At the operator's control panel, he accessed digital information from the rig's Rig Control System regarding control input tolerances, recording such things as milliamps required to move the boom or begin rotation. He entered these as answers to the RigScan checklist items.

Next to this rig was a pre-RCS 1996 Boltec. He demonstrated how the same audit could be performed by manually imputing data indicated on its gauges. To see if the boom's hydraulic requirements were within tolerance, for instance, Jantzen noted a hydraulic pressure reading as the boom responded with the action he called for.

As Jantzen discovered out-of-spec issues, he photographed the concern, typed out the recommended corrective action and moved on to the next item to check.

The full audit took the two men about a shift and a half to complete. However, Roemmich believes that with enough practice it will be possible for one RigScan technician to complete a full 251-point Boltec checklist in a single shift. Back at the office, Roemmich located parts and entered their prices into SMD's audit report.

Big raise underway at Kiruna Mine

SWEDEN Following the completion of the world's largest raise in the U.S., *(see page18)* another big raiseboring project is underway, this time at LKAB's Kiruna Mine in Sweden, the world's largest underground iron ore mine.

The Atlas Copco Robbins 91RH raiseboring machine is being used to construct a skip shaft of 6.6 m in diameter and 250 m long. The work, which is carried out by mining contractor Bergteamet, is being done from four setups, reaming upwards from the 950 m level to the 700 m level.

The Robbins raiseborer is one of the industry's heavyweights. The reamer head alone weighs 40 tonnes and generates 100 tonnes of cuttings per meter. LKAB says it aims to eliminate the risks associated with traditional shaft excavation by using large diameter raiseboring technology.

"The size of this raiseborer and cutterhead makes it special. Hopefully this is the future", says Jonas Bjurholt, Project Manager, LKAB Kiruna Mine.

PHOTO: FREDRIK BJÖRKENWALL, LKAB COMMUNICATIONS

Going up! The huge cutter head on the Robbins 91RH reams up the pilot hole.

A new water well for the soft drinks industry: Successfully completed with Atlas Copco's QL 120 hammer.

A quantum leap to water

UK An Atlas Copco QL120 Quantum Leap hammer has successfully been used to drill a 200 m deep water well in the UK. The well hole was drilled for an international drinks company in Gloucestershire by drilling contractor Apex Drilling Services Ltd.

Using the Atlas Copco QL 120 hammer, the hole was drilled through a limestone sequence, progressing to the Tintern Sandstone horizon.

"The phases involved drilling a 625 mm hole to a depth of 25 m. This was followed by the installation of a 510 mm casing that was grouted in to seal the borehole and avoid ground contamination from entering the well. Drilling continued to 220 m at 406 mm," explains Mike James, Apex Drilling Manager.

James continues: "We removed the shroud for the second phase and replaced the 610 mm button bit with a 406 mm button bit. We easily achieved our target and maintained good flushing."

New rig for stone drillers

WORLD Atlas Copco has launched a high productivity, low cost surface drill rig for the dimension stone industry. The SpeedROC 2F is designed for drilling in marble, granite, sandstone and limestone.

The big advantage is its high productivity provided by a 360-degree coverage area, long boom reach, flexible drilling capacity, fast positioning and high tramming stability.

The all-round coverage saves time when positioning the rig while the long, rotatable boom is perfectly suited to both bench drilling and block processing.

Equipped with the DF 500X or DF 530X hydraulic rock drill, the rig can be used for vertical as well as horizontal drilling of 28–45 mm holes. It has four support legs for total stability as well as Radio Remote Control, assuring operator safety.

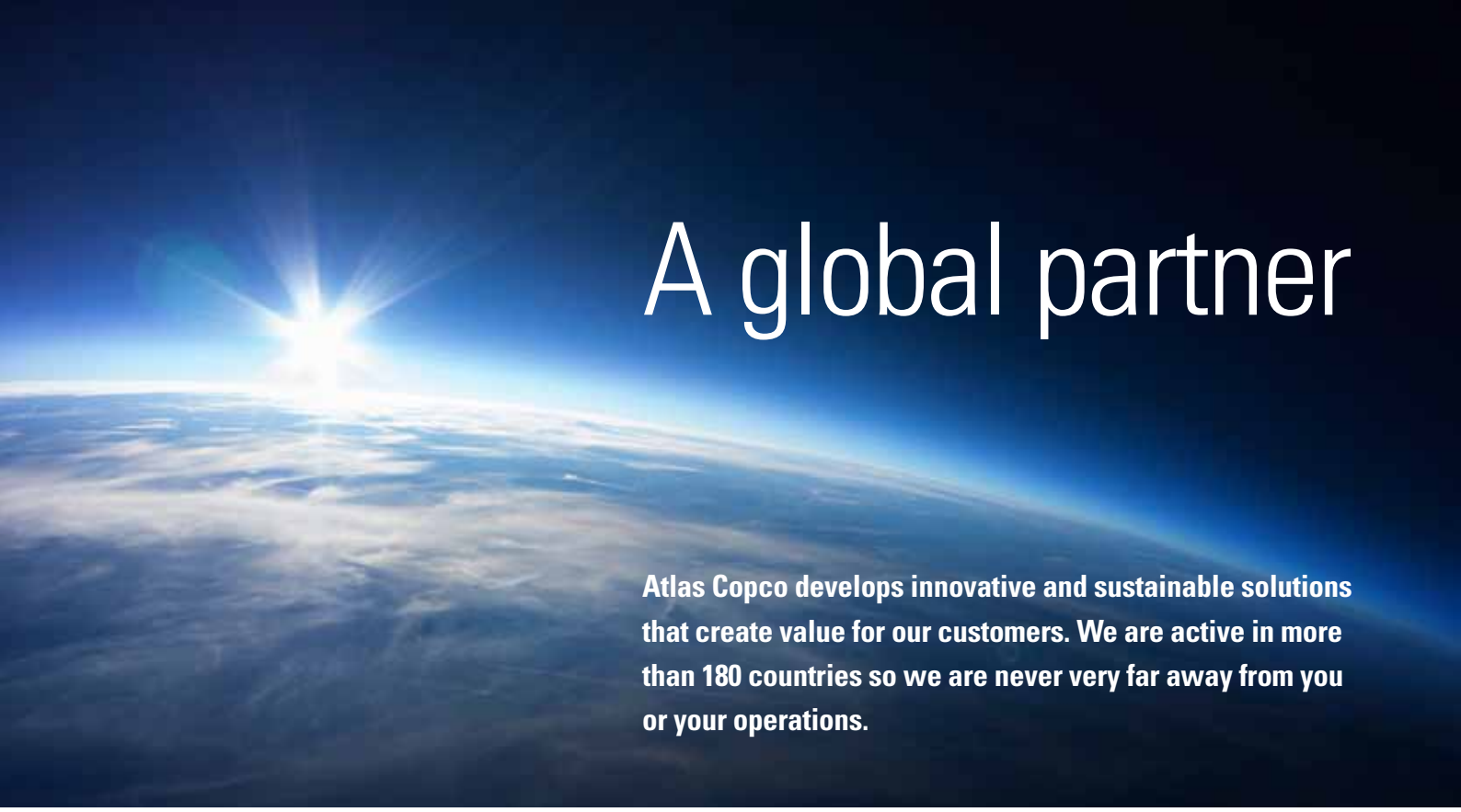
Rock Buggy rocks!

UK The first Atlas Copco Rock Buggy to be delivered to the UK is winning praise from drillers at the Blebe Stone limestone quarry in Lincolnshire.

"With our previous equipment it would take 30 minutes to set up and drill a hole. Using the Rock Buggy the same hole is now drilled in two minutes," explains Andy Smith, Production Director, Glebe Stone.

Fitted with a unique three-way steering system, the Rock Buggy has proven to be the ideal solution, outperforming all other rival equipment on site.

"The Rock Buggy has reduced our costs for drilling both in terms of fuel consumption and manhours. With automated drilling functions we know exactly where each hole should be, giving us a quality pre-split," adds Smith. "Thanks to the rig's remote control system it also improves the health and safety of our employees."



A global partner

Atlas Copco develops innovative and sustainable solutions that create value for our customers. We are active in more than 180 countries so we are never very far away from you or your operations.

WHERE TO FIND US

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