

# Mining

Z I M B A B W E

ISSUE  
02

OCT- DEC 2016

## Remotely Piloted Aircraft Systems

HCCL workers to only  
work two weeks/ month

## Asa update on Indigenisation

## ZMDC Fires Top Management

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# Note from the Editor



Greetings to you all our most valued readers. Second issue out and things are heating up.

The mining industry of Zimbabwe has gone through quiet a shake up with the top three of ZMDC being given the boot for incompetence and Hwange Coillery Company cutting down work to two weeks a month due to financial tough times (page 6).

It is not all doom and gloom though, some exciting things are happening at Metallon Corporation with the launch of their Graduate Training Scheme (page 7) aimed at equipping graduates with the hands on experience they will need to move the mining industry forward.

Speaking of new developments, we also take time to look at the role technology is playing in making mining simpler and safer. We take a closer look at the use of Remotely Piloted Aircraft Systems and how they can benefit mining companies (page 11), we also look at how technology can reduce fatigue-related accidents in the workplace (pages 28 & 29). Safety remains a priority to us as we believe prevention is better cure, and with the mining industry being so prone to underground accidents we give a few tips on how to prevent accidents in the workplace and keep your work environment safe (pages 30, 31 & 34).

Africa as a whole is known for its rich abundance of minerals and each country has its own particular mineral/s that it is known for. Zimbabwe is no exception to this, it is one of the largest Lithium and Platinum producing countries in the world. Read all about how Zimbabwe holds its own in the mineral supply world on pages 16 and 38.

Things sure are looking up and whether you are just an information junkie or a potential investor, this is the publication to read, we have all things mining covered for you all in one place as promised. We love to hearing from you, so feel free to leave your comments on our social media pages and you can also write to us by email.

Happy reading everyone.

We welcome your comments

Contact the editor on [editor@miningzimbabwe.com](mailto:editor@miningzimbabwe.com)

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## MINING ZIMBABWE MAGAZINE

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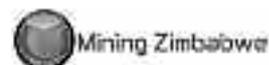
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### About Mining Zimbabwe Magazine

Mining Zimbabwe Magazine is a publication focused on the mining industry of Zimbabwe and how it relates and affects the rest of mining done in other African countries. The magazine's core focus is on the ever evolving face of the mining industry, trends, new technologies, machinery, solutions being developed and used to improve this crucial sector, as well as new opportunities and investments arising from it.

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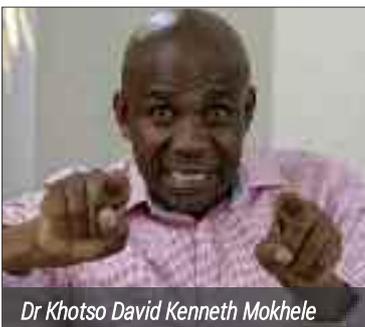


# Masunda and Mokhele to retire at Zimplats



Mr Muchadeyi Ashton Masunda

The board of directors of Zimplats ("the board") wishes to announce that Mr Muchadeyi Ashton Masunda and Dr Khotso David Kenneth Mokhele will retire as non-executive directors of the Company at the annual general meeting of the Company to be held on 14 October 2016. Mr Masunda was appointed as a director of the Company in 2007. He was subsequently appointed as deputy chairman of the board with effect from 1 March 2010. He was acting chairman of the board from 1 July 2012 until 30 June 2015. The board would like to express its sincere gratitude to Mr Masunda for his valuable contribution to the Company over the years. The board and management wish him all the best in the future.



Dr Khotso David Kenneth Mokhele

Dr Mokhele was appointed to the board in 2007. He served as the non-executive chairman of Impala Platinum Holdings Limited from 2009 until his retirement from that position in 2015. The board extends its sincere appreciation to Dr Mokhele for his significant contribution to the Company during his period as a director of the Company. The board and management wish him every success in the future.

For further information please contact:

Alex Mhembere

Chief Executive Officer

Zimplats Holdings Limited

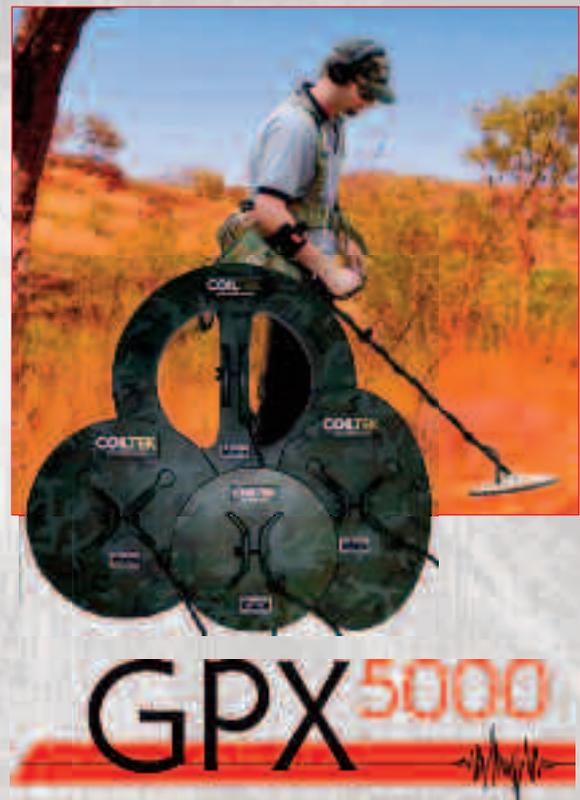
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# Hwange Colliery Company Ltd

## *Workers to only work two weeks per month*



COAL-MINING giant, Hwange Colliery Company Limited (HCCL) introduced a short working programme where workers will work two weeks per month in all departments, effectively slashing their earnings by half as the company battles to contain costs.

The company has been weighing a number of options to deal with its worrisome balance sheet among them retrenchments, being placed on judicial management, complete privatisation and salary cuts.

HCCL managing director Engineer Thomas Makore said management has settled to reduce the working days per month for each employee to guard against workers losing their jobs.

Hwange Colliery Company Limited explores, mines, processes and markets coal, coke and associated by-products. The Company employs more than 3200 people.

## ZMDC Fires Top Management

ZMDC General manager Sydney Simango, chief operating officer Caesar Zishumba and chief finance officer Wilson Chinzou were fired for gross incompetence after struggling to turn around the ZMDC fortunes even though it holds some of the best mining assets in the country and is central to Zimbabwe's economic development.

Acting chairman Dr Farai Karonga confirmed to the Herald Business the corporation had parted

ways with the trio.

The mining group has since introduced a phased recovery approach towards the revival of its three gold mines namely Sabi Gold, Jena Gold and Elvington Gold that were either shut down or put under care and maintenance using scarce internal resources.

Investors were said to be more comfortable in taking up 80 percent and as a result negotiations

around the gold mines have almost always broken down.

According to the sources, ZMDC is also still owed about \$37 million from the disposal of its 40 percent shareholding in Anjin diamond mine and there are concerns that the money will not be recovered following Government's plan to consolidate diamond operations

# Metallon Corporation



## Launch of Graduate Training Scheme

*Metallon Corporation, the gold mining, development and exploration company with producing assets in Zimbabwe and exploration assets in Tanzania and DRC, is pleased to announce the launch of its Graduate Training Scheme.*

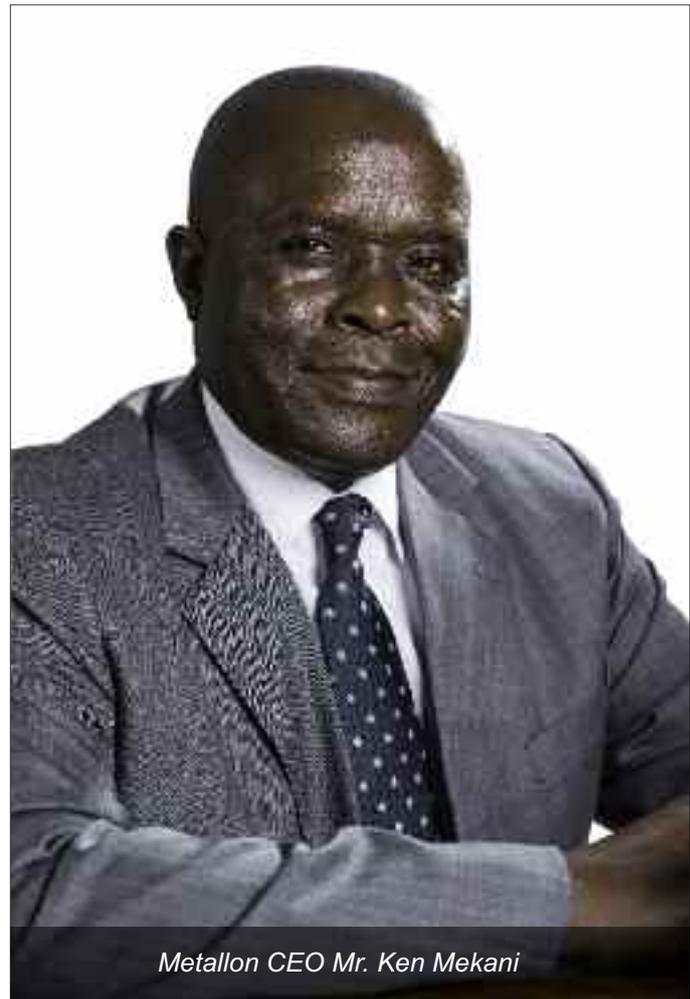
In June 2016 Metallon Corporation commenced its two year Graduate Training Scheme in Zimbabwe. 15 university graduates, aged 18 – 28, were selected from over 1,000 applicants. The selection process comprised of academic merits and grades, interview procedures and psychometric testing. As part of the Scheme the graduates will have a six weeks rotation period visiting all the mining operations to gather a full understanding of the business, before being placed in their target discipline. Disciplines include Mining Engineering, Mechanical Engineering, Electrical Engineering, Geology, Human Resources, Finance, SHEQ ('Safety, Health, Environment and Quality'), and IT. At their disciplines, graduates will work closely alongside highly experienced colleagues and in the future they will have the opportunity to be fast tracked to managerial positions.

Metallon Corporation plans to run its Graduate Training Scheme every two years. Metallon Corporation will soon be extending its learner-ship development programs to the School of Mines and Polytechnic College cadets and apprentices.

Ken Mekani, Chief Executive Officer, Metallon Corporation, commented; "My career commenced when I joined the Company as a Graduate Trainee and, having risen through the ranks over the years, I can demonstrate that this scheme can have a very significant and rewarding impact. We are training the brightest and most dedicated individuals, not only to be good managers of our business, but also to provide the skills and knowledge required for future managers of our country's rich resources. Rebuilding the country's skills base is key to the future growth of the company, and to driving the Zimbabwean economy."

**'It was the opportunity I had been waiting for so I grabbed it with both hands and I was over the moon to hear I had succeeded'.**

Hopeson Chiswa, Head of Human Resources, Metallon Management Services, commented; "We had an overwhelming response from applicants and the candidates had to undergo a rigorous interview and application process. This programme will allow the graduates to fully understand every aspect of the business and become experts in their chosen fields. Mining is a fantastic career choice, and Metallon is the best choice for graduate trainees due to



*Metallon CEO Mr. Ken Mekani*

the diversity of our mining methods and processing plants. What we offer here is a work environment that challenges the trainee and, at the same time, offers fantastic career development opportunities."2

Besina Laula, Graduate Trainee, Metallon Management Services, commented; "Before joining the Graduate Training Scheme, I studied at the Midlands State University, graduating with a degree in Information Systems (IT). I was always interested in working in the mining sector so I was glad to learn that Metallon Corporation had just restarted its Graduate Scheme. It was the opportunity I had been waiting for so I grabbed it with both hands and I was over the moon to hear I had succeeded. I am currently working in the IT department at Metallon Management Services, where I interact with various functions. It is really interesting to see how IT is carried out across all the different operations, and how each operation contributes to the ultimate goal; making sure we mine safely and profitably. I believe mining industry is a great industry to get into and Metallon, being the leader in its field, is the best choice to make for my future. I am keen to get more qualifications, work hard and fully use this experience to achieve great things."



# ZIMPLATS



## PRESS RELEASE on the portal 6 replacement mine

Zimbabwe Platinum Mines (Private) Limited (Zimplats) continues to trail blaze as the leading investor in Zimbabwe since independence. The company has embarked on the development of the Portal 6 replacement mine project. Portal 6 is a replacement mine designed to produce 2.2Mtpa replacing Rukodzi and Ngwarati mines, which deplete in 2022 and 2025 respectively. The full design work and Bankable Feasibility Study (BFS) is at an advanced stage and will be submitted to the company's board for approval. The coming on board of P6 will allow Zimplats to maintain its pole position as the single biggest exporter in the country.

The CEO Alex Mhembe said, "We are really excited about this new. Work on the box cut has commenced and should be completed by calendar year end. The cost for this preliminary work is US\$7.5m and was approved by the board in May 2016. The mine design builds on the successful modern mechanised safe, low cost mining methods that are in place at all of the other portals." He added that "The strike length on Portal 6 has been increased from 3km to 6km making it more capital efficient than previous portals in that the area of interest has been expanded".

According to Zimplats, this portal accesses 63 million tonnes of potential "reserves" at a grade of

3.1 g/t and delivers 3.0 million ounces of platinum and 2.4 million ounces of palladium.

The portal has a life of 34 years and would employ about 800 full time employees and 200 contractors. Once commissioned the portal provides 2.2 million tonnes per annum into the state of the art Ngezi/Selous processing facilities where the material is ultimately beneficiated to a smelted matte in the 12.5MW furnace which has recently been equipped with modern hydraulic mud guns for safe tapping of slag and matte.

Once the P6 project is commissioned, Zimplats would continue to deliver 6.2 million tonnes per



# ZIMPLATS

PRESS RELEASE on the portal 6 replacement mine



Chitsuwa dam 1



Ngezi House

annum and 260,000 ounces of platinum and 220,000 ounces of palladium for more than 30 years

Zimplats continues to deliver record volumes of tonnage and PGM production (+/- 500,000 ounces PGM) safely. Recently the company achieved 5million fatality free shifts, which is an excellent record by international standards. Zimplats has managed to operate at low unit cost in a constrained pricing environment which has necessitated successfully implemented cash preservation measures

The company operates four underground mines in Ngezi, namely Ngwarati, Rukodzi, Mupfuti and Bimha. A major collapse at Bimha mine in 2014 stopped production at the mine, with the shortfall created being provided from increased underground production at Ngwarati and Rukodzi mines and open pit operations being re-instated south of Ngwarati mine. Recognising the need to protect jobs, the company kept all the mining fleets from Bimha Mine and redeployed them to the other mines within the Zimplats stable.

#### Additional information

Zimplats has been investing steadily in Zimbabwe since operations began in 2001 when it developed its first open pit mine.

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# Remotely Piloted Aircraft Systems

## What they can offer for Mining Operations

With rapid growth in recent years and unprecedented improvements in technology, a growing number of mining companies are now adopting a new technology and employing the use of Remotely Piloted Aircraft Systems (RPAS) to assist in streamlining the mining process. RPA systems which are equipped with cameras, stabilising gimbals and gyros, onboard computer systems and a downlink to ground stations; can generate high-resolution aerial imagery for a variety of uses. These images first and foremost can be used to produce highly precise orthomosaic photos, point clouds, 3D models and digital surface models. Surveyors and engineers can use this data to make assessments and forecasts about the development of the mine.

Previously, traditional survey methods meant ceasing operations for a few days to gather data; with advances in technology RPAs can now survey large sites with precision accuracy in a matter of hours, at a fraction of the cost.

Flying above a mine site means operations can continue as normal; disruption in operations are now a thing of the past, saving you time and money. Surveying anywhere from 100ha to 1000ha per day; processing the data in as little as a few days, engineers can now easily monitor the progress of a mine. Volumetric assessments of

stockpiles and pits can produce highly accurate results enabling easy management of the site and digital reports can be rapidly generated.

Workers safety is of paramount importance and is a major priority on any mine site the world over. The adoption of RPA systems improves the safety of mine workers by enabling surveyors to gather data from above the site, RPA systems reduce the everyday risk on the ground and the time spent on site. RPA systems can assess hazardous and previously unreachable areas from the air.

A variety of RPAs can be used depending on the desired result. Larger areas require the use of fixed wing drones with a longer flight time - surveying thousands of hectares per day. Smaller RPAs and multi-rotors such as quad and octocopters offer shorter flight time but more precise flying, without the need for a large open area for takeoff and landing; usually able to complete a few hundred hectares in one day. A separate benefit of using multi-rotors is the control that they provide - fixed wing drones require constant movement to continue flying whereas multi-rotors can be held in one position - controlled to hover in a certain area offering the operator and any spectators the opportunity to inspect large equipment, buildings, bridges and masts. Traditional inspection of a bridge could take a team of 6 engineers equipped



Launching a fixed wing Drone

with ropes and harnesses a week to inspect a bridge whereby a RPAS could complete the same bridge with one engineer and the drone operator, in a matter of hours.

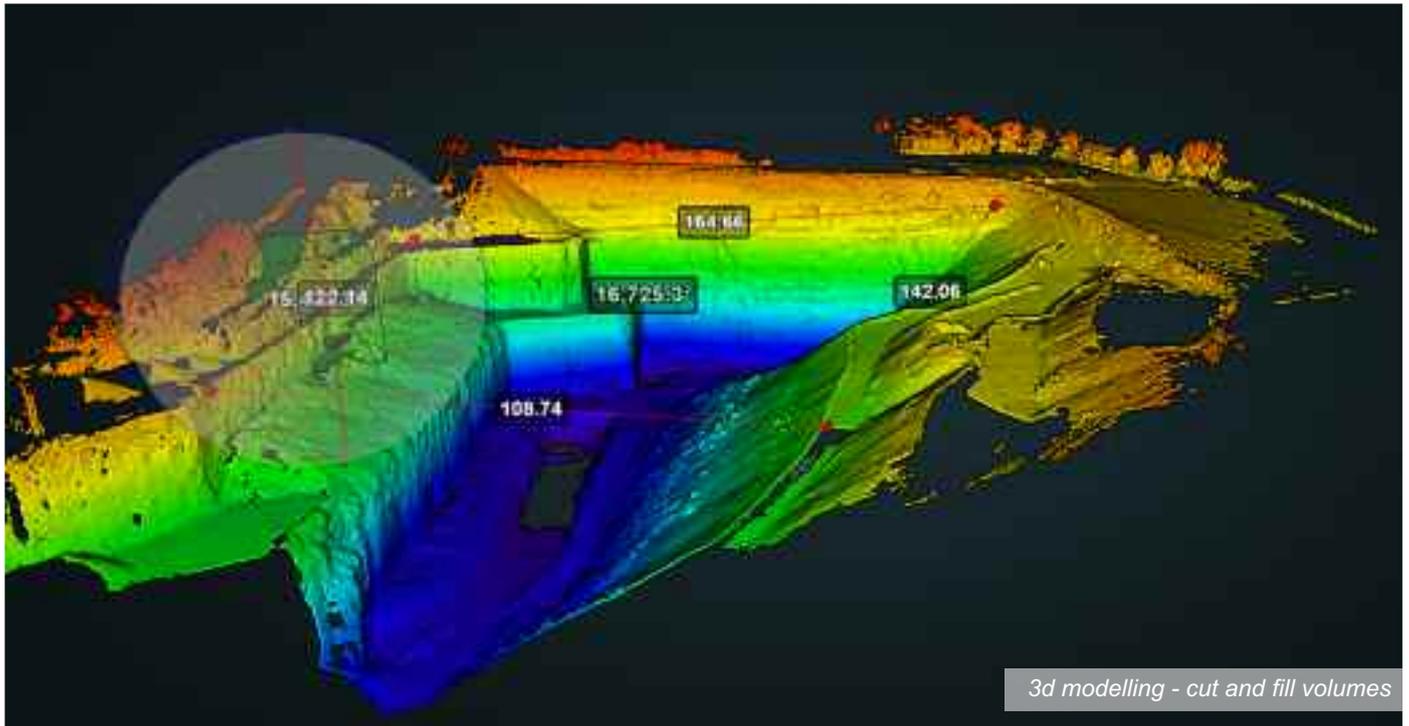
Recent advances in technology have seen the adoption of new sensors designed to assess the blast cloud. Drones equipped with specific sensors are flown above a blast site immediately following the blast and detect the gases that are given off; similar to the way drones are being used to assess the quality of ore. Previously, on Uranium mine sites, workers would suit up in radiation resistant clothing in order to assess the outcome of the blasting; now mines are adopting RPAs to detect the level of radiation being given off before allowing people access to the site.

Scout Aerial Africa is the only company specialising in the use of RPA systems in Zimbabwe. Part of the Scout Aerial Group of companies, they have been operating in Southern Africa since 2015 and offer high tech aerial solutions for aerial media, survey/mapping, inspections, precision agriculture and anti-poaching.

Speaking with Operations manager at Scout Aerial Africa, Mike Kirstein, he says "The uptake and acceptance of this new technology has initially been slow within Zimbabwe, however the benefits of its use cannot be argued."



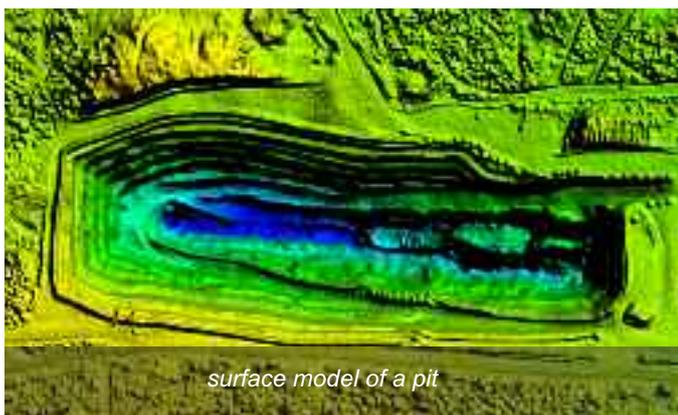
# Remotely Piloted Aircraft Systems



"We can complete a survey of a 1000 hectares site in under 2 days; from this we can generate digital surface models, terrain models, 3d models, contour maps, volumetric assessments of stockpiles, waste dumps and pits, virtual reality walk-throughs to show to shareholders and investors. The uses are numerous."

"Currently the focus we see is on the technology - everybody wants to know which RPA system are you using and how do you use it? These details are irrelevant - it is really the deliverables and the kind of results we can give you that is important."

"In terms of the accuracy - several studies have been done on this and the data we provide is unmatched in terms of efficiency; whilst producing accuracy equivalent to that of traditional surveys (that will typically take days to complete.)"



## Utilising RPA systems, value can be added in the following areas to name a few:

- \*Pit, stockpile & dump management
- \*Haul route surface optimisation and design
- \*Storm damage assessment & control
- \*Mapping of inaccessible areas
- \*Up-to-date surfaces for optimised blast designs
- \*Pre- & post-blast data
- \*Identification of misfires & wall damage
- \*Grade control & exploration planning
- \*Drainage and water management, contour mapping
- \*Thermal detection of ground water inflows
- \*Tailings dam management
- \*Feasibility studies
- \*Leach pad, dam wall & platform construction quality control
- \*Progress monitoring & reporting
- \*Geophysical & watershed/catchment area modelling
- \*Security

"If anyone is interested in hearing about this amazing new technology that is changing the mining industry across the world, please don't hesitate to get in touch."

We look forward to helping you implement an aerial survey solution using RPAS."

For more information you can visit their website at [www.scoutaerialafrica.com](http://www.scoutaerialafrica.com) or please call Mike Kirstein on 0777 081 259.

# Condition Monitoring Company WearCheck now in Zimbabwe

South Africa-based condition monitoring company WearCheck has opened two more cross-border laboratories, bringing to 13 the number of laboratories operated by the company, in nine countries.

Electrical operations and other industrial concerns in Zimbabwe now have their very own local WearCheck laboratory, right on their doorstep.

WearCheck, recently acquired the long-established oil analysis laboratory in the form of Harare-based Tribology Services, and brought it into the WearCheck fold.

The Zimbabwean laboratory has been operating for 27 years, and already services a wide range of clients. Now, as well as traditional oil analysis, WearCheck Zimbabwe also conducts thermography, vibration analysis, balancing, laser alignment, motor current analysis and milling. WearCheck Zimbabwe offers on-site sampling, as well as a 24-hour sample turnaround.

In addition to the new laboratory North of the border, WearCheck also headed West, and recently opened an on-site condition monitoring laboratory in Namibia, at the Husab Uranium Project. Swakop Uranium, owners of the mining operation, awarded WearCheck a 5-year contract to supply and operate an on-site laboratory for the mine.

As an open-pit mining operation, Husab uses the conventional truck and shovel mining method. WearCheck's laboratory is well-placed to maintain the plant used in this process – including a huge scale of loading and hauling equipment – at optimum output capacity. This aligns perfectly with the WearCheck target to help save customers time and money through reliability solutions for plant maintenance

The Namibian laboratory was set up as part of a joint venture with sister company, Set Point Laboratories, who built and supplied the assay side of the laboratory.



For WearCheck managing director Neil Robinson, the company's expansion is a positive move. 'We are delighted to have the privilege to do business across South Africa's borders, and have been made very welcome in Zimbabwe and Namibia. By extending our geographical footprint, we are now able to offer condition monitoring services to many more industrial operations, which previously had no access to these services.

'WearCheck's laboratory instruments are constantly upgraded to remain at the forefront of international standards, and our staff members attend ongoing training courses to keep ahead of global condition monitoring trends.'

This year, WearCheck celebrates their 40th anniversary of condition monitoring excellence.

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**Zach Yacumakis**









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# Understanding the Portnex/ Zimasco Relationship



As part of its strategy to sweat its idle assets, Zimasco leased its 3 West plant furnaces to Portnex International, a South African company. The deal is for 5 years effective 10 December 2015 and terminating on 9 December 2020 with the following salient features;

Prior to Portnex commencing operations, Zimasco brought its furnaces to a status where they were ready to be operational at our own cost.

Portnex, for a leasing fee, then took over the ready to operate furnaces and are expected to run them as if they are their own i.e. they are responsible for all inputs needed to smelt chrome ore to produce high carbon ferrochrome and sell it for their own benefit. They are also expected to maintain the furnaces in good condition and return them to Zimasco at the termination of the contract in the same state and condition that they found them in when they started leasing them.

The often spoken about \$12 million 'investment' by Portnex is money that Portnex is expected to

use for their working capital to run a ferrochrome production business with part of it paying for Zimasco's leasing fee and services. Portnex are currently running 2 furnaces, although they are yet to achieve optimum production on these two units. They intend to run a 3rd furnace as soon as it has been refurbished. All the costs incurred by Portnex to refurbish the furnace will be recovered by Portnex from Zimasco.

Portnex is currently getting some of their chrome ore from Tributors (mining contractors) working on Zimasco claims. The balance of their chrome ore they are sourcing from other small scale suppliers and claim holders.

Portnex is developing its own ore supply channels as Zimasco is at an advanced stage to resume its smelting operations on its 2 East Plant furnaces which are currently switched off. There is no refurbishment work needed on these two furnaces as they were only switched off in December due to low prices.

Zimasco provides Portnex support services such

as:-

- **Laboratory**
- **Sizing and Crushing**
- **Weighing**
- **Transport**
- **Security and**
- **Secondary metal recovery.**

A misconception in the market is that there is a discussion between Zimasco and Portnex to provide a \$5million facility to Zimasco. This is not true and according to Zimasco there are no such discussions underway.

Zimasco's imminent resumption of operations are based on a full business restructuring plan that has been put in place of which the Portnex leasing arrangement plays only a small part (~10%) especially given that this arrangement is a temporary one as their lease will terminate in 2020

# Zimbabwe the only African Country in the top 5 Lithium Producing countries

A soft, silver-white metal, lithium is part of the alkali metal group. It is highly reactive and flammable. Due to its high reactivity, it hardly occurs in the free state in nature and is always found in the form of compounds. After the Second World War, lithium production experienced a boost due to technological advances and the need to produce nuclear fusion weapons. To commercially produce lithium, salts are extracted from water in mineral springs, brine pools or brine deposits. Then the metal is produced through electrolysis from a mixture of lithium chloride and potassium.

## The Applications Of Lithium

Rechargeable batteries for a variety of devices like mobile phones, laptops, digital camera and more utilize lithium. Certain non-rechargeable batteries for items like clocks and pacemakers also make use of the metal. Lithium metal can also form alloys with aluminum or magnesium, which is used for armor plating and in aircraft, bicycles, and trains. Lithium carbonate is used in the field of making glass and ceramics. It is also involved in producing aluminum. Lithium stearate is used in cosmetics, plastics, and its grease is used in aircraft and marine applications as well as other areas.

### 1. Australia

Australia is the world leader in lithium production. Australia has the Greenbushes, which is the world's largest known single lithium reserve. Companies are also looking at restarting lithium production at Mt. Cattlin in Western Australia. Unlike Chile and Argentina whose lithium is found in brines below the surface of salt flats, Australia extracts lithium from traditional hard-rock mines and exports a proportion of it to China and other Asian countries.

### 2. Chile

Chile produces the second most lithium at 12,900 metric tons in 2014. Chile, like Argentina, benefits from geological conditions that created lithium-rich salt flats. The Atacama salt flat is Chile's most significant source of lithium production. Chilean mines feature the largest confirmed lithium reserves in the world. By some estimates, the country hosts five times more lithium than Australia.

### 3. China

China produces the third most lithium at 5,000 metric tons. The majority of the country's lithium comes from the Chang Tang plain in western Tibet. China has to fully ramp up its lithium extraction as the need for the metal is steadily rising. China also has a large domestic market for lithium. For now, China gets a lot of its lithium supply from Australia.

### 4. Argentina

Argentina produces the fourth most lithium at 2,900 metric tons. Argentina benefits from geological conditions that created lithium-rich salt flats which fuel lithium production. The most significant salt flat is the Salar del Hombre Muerto, located in the northwestern part of the country.

### 5. Zimbabwe

Zimbabwe produces the fifth most lithium at 1,000 metric tons as per 2014 reports. One company, privately held corporation Bikita Minerals controls nearly all of the country's lithium mining. The Bikita mine, one of the biggest in Zimbabwe, is located to the south of the country.



# Zimbabwe World Number 3 in Platinum Production

Platinum is a dense, malleable, highly unreactive gray-white precious metal. It is also considered a noble metal due to its remarkable resistance to corrosion. Platinum is one of the rarest metals. About 97% of the world's total platinum comes from one of five countries: the United States, Canada, Zimbabwe, Russia and South Africa. Platinum is found deep underground, mostly in nuggets or grains and is usually alloyed with other metals. Platinum was earlier extracted using the narrow reef method, which involves drilling holes and then loading explosives into them. However, now newer hybrid mining methods are being used which involves drilling holes and then cleaning the ore using load-haul-dump machines. After mining, the platinum needs to be cleaned to remove traces of other metals. This process is about five times harder than gold cleaning.

## The Uses And Attraction Of Platinum

Platinum is used in many objects and devices including laboratory equipment, electrical contacts, dentistry equipment, computer hard disks, turbine blades and more. Platinum is probably best known for being extensively used in jewelry, but its primary use is in catalytic converters for diesel engines in vehicles which account for around half of its demand. Platinum is seen as a metal of exclusivity and wealth because like its counterpart gold it is a very rare, expensive precious metal that is heavily used in jewelry and can only be acquired by the very wealthy. It has also been used by royalty, like King Louis XV of France and Queen Elizabeth, since its discovery by Europeans adding to this notion.

### 1. South Africa

*(110,000 kg, 68.32% of world's platinum)*

South Africa is the world's largest platinum producer, producing more than twice as much as every other country on Earth combined. South Africa has three major platinum bearing areas, the Merensky Reef, the Upper Group 2 (UG2) Reef and the Platreef. The Merensky Reef, the major platinum source, was first used for platinum

mining in 1925 until the close of the 20th century. The UG2 Reef opened in the 1970s and from then on became the major source of platinum in South Africa, accounting for over a majority of the platinum mined in the country. The Platreef was not mined on a large scale until 1993 and is the third largest platinum mine in the country. Mining in the country has taken a hit in recent years due to labor strikes, protests, safety concerns and scandal involving the mining companies.

### 2. Russia

*(25,000 kg, 15.52% of world's platinum)*

Russia is the second largest platinum producer in the world, producing as much as every other country in the world, besides South Africa. Platinum was first discovered in Russia's Ural Mountains in 1823 and have been mined ever since. Platinum from the Urals started to decline in the 1920s but in 1935 platinum-containing cooper-nickel deposits were found on the Taimyr Peninsula in Siberia. Since then various mines in the region have come and gone but this area remains the most important for Russia's platinum reserves.

### 3. Zimbabwe

*(11,000 kg, 6.83% of world's platinum)*

Zimbabwe is the third largest platinum producer in the world. Zimbabwe has three major platinum mines located in a geological feature that runs through the center of Zimbabwe called the Great

Dyke. These mines are the Mimosa operation in the southern part of the Great Dyke, it is the oldest platinum mine in the country, starting briefly in the 1920s, then again operating from 1966 to 75 and then since 1994. The Zimplants mine started in the early 1990s, while the Unki mine was commissioned in 2010.

### 4. Canada

*(7,200 kg, 4.47% of world's platinum)*

Canada is the fourth largest platinum producer in the world. Platinum was first discovered in Canada's Ontario province in 1888. The majority of Canada's platinum supply comes from the Sudbury Basin in Central Ontario. Most of the rest of Canada's platinum comes from the Raglan nickel mine in Manitoba, Quebec, and the Lac des Iles mine in Western Ontario.

### 5. United States

*(3,650 kg, 2.26% of world's platinum)*

The United States is the fifth largest producer of platinum in the world, despite only having one mining company that mines platinum. The Stillwater Mining Company is the only producer of platinum in America. It has two mines from where the platinum is derived. These are the Stillwater Mine, located in Nye, Montana, and the East Boulder Mine, which is located by Big Timber, Montana.

*Extract - World Atlas*



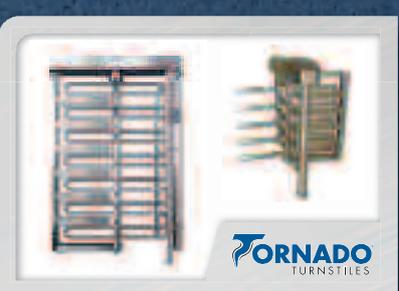


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# Asa Resource Group update on Indigenisation

In 2007, the Zimbabwean Government published the Indigenisation and Economic Empowerment Act which made provision for the indigenisation of up to 51% of all foreign owned businesses operating in Zimbabwe. Regulations in support of the Indigenisation Act were published in February 2010 in preparation for the implementation of the Act.

On 25 March 2011 the Minister of Youth Development, Indigenisation and Empowerment published a notice in the government gazette promulgating the Indigenisation and Economic Empowerment (General) Regulations in statutory instrument 21 of 2010. The document sets out the requirements for the implementation of the Indigenisation Act and its supporting regulations as they pertain to the mining sector. These regulations include the requirement to sell a sufficient shareholding so that 51% or a controlling interest is owned by indigenous Zimbabweans, and/or provides for foreign investors to earn indigenisation credits to meet the ownership requirements.

During the year ended 31 March 2013, the Company disposed of 15% of Freda Rebecca Gold Mine to an indigenous Zimbabwean.

A community trust was established in the year ended 31 March 2013 and discussions continue with this trust about a disposal of some shareholding in Freda Rebecca to this trust.

In April 2016, the President of Zimbabwe issued a statement to clarify the requirements of the Indigenisation Act, specifically as it relates to the natural resource sector. This clarification



*Freda Rebecca Mine - Bindura*

allows existing companies to comply with indigenisation law by retaining 75% of revenue in Zimbabwe for example through employing local employees, procuring local services, and investing in the community.

## The Company disposed of 15% of Freda Rebecca Gold Mine to an Indigenous Zimbabwean

Should a company fail to comply with the law, it would be given an opportunity to rectify its position, but ultimately the Zimbabwe government has the right to rescind its mining licenses or expropriate assets.

The Group has prepared and filed a compliance plan for its Freda Rebecca gold mine. The plan is now in the process of being considered by government ministers. The Group is also in the process of preparing the plan for the BNC nickel mine, and intends to submit it for consideration before the end of the year. The directors have ongoing interaction with the ministers and are confident that the Group will continue to hold and have access to the mining licenses in place.

While the Group is progressing these plans to

conform with indigenisation legislation, it is not currently in compliance. This non-compliance with the legislation could potentially result in rescindment of mining licenses in Zimbabwe held by the Group, which could have a material impact on the financial statements, including the carrying value of assets, and the application of the going concern basis of accounting.

The directors intend to comply with this legislation and believe the Group has a constructive relationship with the Zimbabwean government such that the license rescindment is unlikely. Nevertheless the directors recognise that there is a material uncertainty associated with current non-compliance with indigenisation legislation and how this might be enforced, that may impact the recoverable amount of its Zimbabwean mining assets and that may cast significant doubt on its ability to continue as a going concern.

Asa resource group (Formerly Mwana Africa) owns 85% of Freda Rebecca Gold Mine, 75.4% interest in Bindura Nickel Corp, 50% interest in the dormant Maligreen Gold Mine, 100% ownership of the Makaha Deposit. The gold mine is situated near the town of Bindura, some 90km north-east of Harare, Zimbabwe.

# KEYS TO EXTENDING tire life

We all know the importance of equipment management to minimize production interruptions related to maintenance downtime. How much attention does your operation pay to the management of its heavy equipment tires? Not all tire management, however, directly involves the tires. Other factors in your operations can influence tire performance and wear life.

Mine design, employee training, equipment modifications, servicing dealers, and record keeping can also affect productivity and tire performance. Take a look at these factors when putting together or evaluating your tire management programs.

Consider an operation with 100-ton haul trucks equipped with 27.00R49 tires. Each truck's tires, when purchased new, cost between \$38,000 and \$44,000. This is definitely an asset you want to make last as long as possible. Many individuals within your organization contribute to extending or diminishing tire life.

Starting with quarry design engineers, considerations to take into account when designing the mine include grades, road crown, road surface, super elevations, and uphill and downhill loads. How do these design features affect the tires?

## Grades

Steep grades can cause tire slippage resulting in increased tire wear and slower trucks.

- *Steep grades increase the amount of load transfer to the tires and suspension components.*
- *Load transfer onto front tires in downhill hauls can cause overloading, resulting in increased tire temperatures, which is a primary factor in poor tire*

performance.

- *Overly steep grades require operators to use multiple transmission shifts to make the climb. These shifts can cause additional shearing forces within tires causing or increasing separations.*
- *The recommended gradient is 6 percent.*

## Road crown

Ideally, haul roads should be the width of three trucks, allowing for easy passing on the roadway. Ideally, haul roads should be the width of three trucks, allowing for easy passing on the roadway. Road crown is incorporated into haul road designs to disperse water off haul road surfaces, but care should be taken to ensure that all tires are evenly supported by the road surface. Surprisingly, people don't realize how much of an enemy water is to tires. A wet tire cuts eight to 10 times easier than a dry tire.

Designers should also take into consideration the type of material used to build and maintain haul roads. Ideal materials compact more firmly and resist potholes. Some materials act like marbles, causing slippage of the tires that can slow trucks

(production) and cause tread cutting, chipping, and premature wear.

A helpful reference for haul road design and maintenance is MSHA's Haul Road Inspection Manual. And, BKT Tires, Inc. and other manufacturers provide off-the-road tire maintenance manuals with other useful information to extend tire life and minimize tire damage.

Tire manufacturers and their authorized dealers offer a number of services to identify design issues that affect tire performance. Technical teams are capable of running real-time haul road analysis, targeting real-time critical forces affecting tires in order to correlate haul road conditions to tire life. Spotech (Satellite Performance Optimization Technology) is one tool available to measure speed, latitudinal, longitudinal, and vertical g-force accelerations by using internal accelerometers to generate data for analysis to ensure issues are addressed before they become irreparable problems.

A majority of quarry operations do not have a tire



*Ideally, haul roads should be the width of three trucks, allowing for easy passing on the roadway.*

Continued from Previous page

# Keys to extending tire life

shop and dedicated maintenance staff to monitor tire performance. In these situations, quarry operators rely upon OTR tire dealers to provide service and track tire performance. On average, a service call to remove and replace a haul truck tire averages around 4 to 5 hours. This means your truck loses this amount of time, if not longer, away from production. Some questions to ask when assessing OTR tire dealers include the following:

- *Where is the tire shop in relationship to the quarry?*
- *Does the tire dealer have service trucks capable of safely handling OTR tires?*
- *Are the service truck technicians and salespersons certified?*
- *What kind of OTR training do the technicians have?*
- *Does the dealer have 24-hour service?*
- *What kind of tire tracking and recordkeeping does the dealer offer?*
- *Does the dealer offer tire pressure monitoring on a regular basis? Weekly is recommended.*
- *Does the dealer have certified OTR sales representatives that are able to assess site conditions and make appropriate tire recommendations suitable for your operations?*
- *A servicing tire dealer with well-trained and equipped sales and service personnel is an important asset to optimize your production and profit.*

Another key element of a great tire management program is employee training and the establishment of best practices, including the following:

- *Training haul truck drivers to stay on the bench and avoid backing into debris will minimize rock cuts and sidewall damage.*
- *Loader operators working the face should be vigilant in keeping the bench free of rock debris by cleaning between loads.*
- *Center loading of haul trucks is another important consideration as it minimizes overloading of any one or pair of tires.*
- *Haul truck operators should avoid driving over rock spillage. A rock the size of a fist causes the most damage to equipment tires.*
- *Start-of-shift operator inspections should include inspection of the tires and weekly pressure checks.*

Haul road maintenance is another critical aspect of an operation's tire management program. Regular clearing of debris from haul roads is a must for tire protection. Haul roads should be designed the width of three haul trucks. Narrow haul roads cause drivers to ride on or very close to the berm and can result in cuts and tire damage. A 'drive on the left' traffic pattern can minimize driving on the berm as the driver is better able to see the edge of the haul road. Consider also that mismanagement of the haul roads can



*Notice the very tight turn and steep elevation of this haul road.*

result in decreased production as trucks will slow down to minimize fatigue when roads are in poor condition.

Rock slots are another best practice in maintaining haul roads. When a motor grader is in the process of clearing rocks from the haul road, it frequently just pushes the rocks up against the berms. This results in two situations; the berm gets larger and the haul road gets narrower and/or rocks are still in the driving path of the trucks.

The next aspect of great tire management programs is to consider the effect equipment modifications have on the tires. The air inside a tire is the single most important part of the tire. It is the air that carries the load of the vehicle and its payload. The tire itself is the vessel that holds the air. Tires are designed to carry the quoted payloads and gross vehicle weight of the machine. Haul truck modifications such as the addition of sideboards to increase the payload or the addition of fuel tanks so trucks can run longer without stopping are great for increasing production, but at what cost? The addition of these items can increase the gross vehicle weight by thousands of pounds. Dealers make tire recommendations based upon published gross vehicle weights and payloads. Savvy dealers will ask questions of the operations or maintenance managers prior to making tire recommendations, but, ultimately, it is the responsibility of the operation to inform dealers of equipment modifications to avoid premature tire removal resulting from overloading.

To wrap up this discussion, consider that some damaged OTR tires can be repaired, so keep a scrap pile of slightly worn and repaired tires on hand. While these tires may not be suitable for your heaviest loads, you may be able to get a little more life by rotating them to the front of haul trucks or the rear of loaders. Remember the best recommendation is to be proactive and prevent early or unexpected tire removal and keep production rolling!

# AFROMIX

## Afromix - is designing and manufacturing the benchmark in pressure Oxidation agitators

AFROMIX has a highly respectable reputation in the mining industry for the design and manufacturing of high quality Agitators and Peristaltic Hose pumps. Part of their specialisation is the design and manufacturing of Pressure Oxidation, high-pressure Oxidation and Autoclave leaching agitators.

Pressure oxidation (POX), high-pressure oxidation (HiPOX) and ACTIVOX autoclave leaching are practical industry-standard technologies. These technologies are used to recover metals such as gold, copper, nickel, platinum and uranium. Once the metals are put into a solution, the valuable material can be recovered by processes such as electrowinning or chemical precipitation. Electrowinning, also known as electroextraction, is the electro-deposition of metals from ores that have been put into a solution by a process called leaching. Chemical precipitation, on the other hand, is the formation of a separable solid substance from a solution, either by converting the substance into an insoluble form or by changing the composition of the solvent to diminish the solubility of the substance in it. AFROMIX have, over the years, supplied many agitators for autoclaves used in nickel, copper and platinum

projects.

AFROMIX has supplied agitators with the P4 impeller, with a proven track record in gas dispersion, to several projects in the platinum and base metal industry. After extensive research and development work, AFROMIX's dual impeller agitator, the P3, and P4 combination have been installed on numerous plants across the world. The mechanical design of autoclave agitators requires extensive knowledge of the operating conditions.

Furthermore, the understanding and ability to predict these extreme forces acting on the agitator drive are essential to a successful installation. The design needs to accommodate these factors and protect each component to eliminate any failures. AFROMIX have design programs incorporating this experience that ensures reliable, well-engineered agitators for high-pressure applications.

AFROMIX's agitators has been successfully installed onto Platinum Mines in South Africa and also Copper Mines in The Democratic Republic of the Congo and Zambia.

The company is growing their international



footprint rapidly. AFROMIX's manufacturing facility is situated in Uitenhage in South Africa, which offers skilled workman ship and also a harbour for exports. AFROMIX has worldwide representation with offices in South Africa, Canada, and The United Kingdom, but also offers representation on every continent in the world through our trusted distributors.

AFROMIX has a high regard for client service and will go above and beyond to create customer satisfaction, thus AFROMIX is working hand-in-hand with *Marjen Mining & Industrial Supplies in Bulawayo, Zimbabwe*, to offer a hands on approach with an agent readily available to look after the end user.

You can get in touch with afromix on +27 11 397 6712 or [www.afromix.co.za](http://www.afromix.co.za)



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# Caledonia Mining Corporation Plc results for the Second Quarter and First Half of 2016



**Caledonia Mining Corporation Plc** announces its operating and financial results for the first half of 2016 ("H1" or the "Half Year") and the second quarter of 2016 ("Q2" or the "Quarter"). All results are reported in United States dollars unless otherwise indicated. Following the implementation of indigenisation in September 2012, Caledonia owns 49% of the Blanket Mine in Zimbabwe. Caledonia continues to consolidate Blanket and the operational and the financial information set out below is on a 100% basis unless otherwise indicated.

*1 "On-Mine Cost per ounce", "AISC" and "average realised gold price" are non-IFRS measures and are explained in Section 10 of the MD&A*

*2 Gross profit is after deducting royalties, production costs and depreciation but before administrative expenses.*

*3 Adjusted EPS is a non-IFRS measure which aims to reflect Caledonia's ordinary trading performance and is discussed in Section 10 of the MD&A*  
*Commenting on the results for the quarter and half year to June 30, 2016,*

Steve Curtis, Caledonia's President and Chief Executive Officer said:

"The results for the second quarter represent a substantial improvement on previous quarters as we begin to see the benefits of the continued investment at Blanket and as a result of the improved gold price. Adjusted earnings per share in the second quarter were 144 per cent higher than quarter 1 of 2016 and over 300 per cent higher than in the second quarter of 2015. Caledonia remains confident of meeting market expectations for the remainder of 2016.

"A new production record was largely the result of improved underground logistics and increased mine flexibility as a result of the implementation of the Revised Investment Plan at Blanket Mine. This achievement is a testament to the hard work of the management and employees at Blanket Mine and the technical team at Caledonia over the last 18 months.

"Gold production in the quarter was 15.6 per cent higher than the first quarter of 2016 due to the increased tonnes mined and milled and the improved grade. The average feed grade in the quarter was 3.47 grammes per tonne compared to 3.16 grammes per tonne in quarter 1 and 3.25 grammes per tonne in 2015. The higher grade was as planned and reflects

the commencement of production from the AR South and Blanket ore bodies below 750 meters. In future quarters I expect the grade will improve towards 4 grammes per tonne as production from higher grade, deeper ore bodies increases.

"Our increased confidence in the future financial performance of the group is reflected in the increase in Caledonia's dividend. With effect from the end of July 2016, Caledonia's dividend has increased by 22 per cent from 1.125 cents per quarter to 1.375 cents per quarter. Caledonia's dividend remains sustainable with dividend cover for the quarter of over 4 times earnings and 10 times operating cash flow.

"Higher production results in a lower average cost per ounce as fixed costs are spread over more production ounces. The All-In Sustaining cost for the quarter was \$936 per ounce - 9.5 per cent lower than the comparable quarter of 2015. Costs at Blanket and Caledonia remain well-controlled and I expect to see further reductions in the average cost per ounce as production increases in terms of the production plan.

"Improved profitability was also reflected in Caledonia's improved cash position. At June 30, 2016 Caledonia had cash of \$10.6 million and no debt, compared to net cash of \$8.8 million at March 31, 2016. In early August 2016, Blanket re-commenced dividend payments after approximately 18 months during which dividends were suspended so that it could re-invest its operating cash flows in terms of the Revised Investment Plan. The resumption of dividend payments by Blanket will further enhance Caledonia's cash position and also means Blanket's indigenous shareholders will participate in Blanket's improved financial performance.

"We have increased our focus on exploration and resource development which has resulted in regular resource updates. I am confident that the life of mine will be further supplemented by resource additions and upgrades. A huge amount has been achieved at the Central Shaft since work commenced in late 2014: the sinking head gear has been installed and commissioned and the main sinking phase has commenced. Completion of the Central Shaft remains on track for mid-2018 with the shaft depth currently standing at 170m. The completed shaft down to a level of 1,080m will establish Blanket as a large, low cost operation with excellent prospects to extend the existing mine life.

"2016 has been a transformational year for Caledonia and Blanket to date and I look forward to providing further updates to the market as the year progresses."



For detailed information Contact  
Caledonia Mining Corporation Plc  
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# CALEDONIA

## Mining Corporation Plc:

### *Q3 2016 Production Update & New Ball Mill Commissioning*

Caledonia Mining Corporation Plc ("Caledonia" or the "Company") (TSX:CAL)(OTCQX:CALVF)(AIM:CMCL) announces gold production from its 49 per cent owned subsidiary, the Blanket Mine ("Blanket") in Zimbabwe, for the quarter ended 30 September 2016 ("Q3 2016" or the "Quarter"). All production numbers are expressed on a 100 per cent basis and are based on mine production data and are therefore subject to adjustment following final assay at the refiners.

Approximately 13,430 ounces of gold were produced during the Quarter, representing a 23 per cent year on year increase on the gold produced in Q3 2015 (10,927 ounces) and a 7.4 per cent quarter on quarter increase on the gold produced in Q2 2016 (12,509 ounces). Caledonia remains on track to meet production guidance for 2016 of 50,000 ounces and continues to progress towards its long term target of 80,000 ounces by 2021.

Caledonia is also pleased to announce that in terms of the ongoing investment programme at Blanket Mine, a new ball mill has been installed and the commissioning process is proceeding as anticipated. The new mill will increase daily throughput at the Blanket plant by 20 per cent, from 1,500 t/day to 1,800t/d, and will allow Blanket to meet its plan to double 2015 production to 80,000 ounces by 2021. Commenting on the production for Q3 of 2016 and on the installation of the new ball mill, Steve Curtis, Caledonia's Chief Executive Officer said: "Production in the third quarter was in line with expectations, and shows that Caledonia and the Blanket Mine remain on track to deliver our target performance for 2016.

Production in the Quarter includes production from higher grade material below 750 meters which is accessed via the No. 6 Winze and an additional decline development. This is further testament to the investments Caledonia has made to increase production flexibility and capacity over the past 18 months, which are now beginning to bear fruit as production from below 750 meters continues to increase. We are also pleased that the new mill, which was manufactured locally in Zimbabwe has been installed and the commissioning process is progressing as expected as it is an important step in increasing our production to 80,000 ounces over the next 4 years."

#### **About Caledonia Mining**

Following the implementation of indigenisation in Zimbabwe, Caledonia's primary asset is a 49% interest in an operating gold mine in Zimbabwe ("Blanket"). Caledonia's shares are listed in Canada on the Toronto Stock Exchange as "CAL", on London's AIM as "CMCL" and are also traded on the American OTCQX as "CALVF".

At 30 June 2016, Caledonia had net cash of US\$10.6m. Blanket plans to increase production from 42,800 ounces in 2015 to approximately 80,000 ounces in 2021; Blanket's target production for 2016 is approximately 50,000 ounces. Caledonia expects to publish its results for the quarter to 30 September 2016 on 14 November 2016.



# Software from 3D Laser Mapping allows accurate Slope Monitoring through wire mesh and netting



The use of wire mesh or safety netting can often limit the ability to capture detailed measurements of a rock surface resulting in poor or inaccurate information regarding the movement of the slope.

SiteMonitor4D from 3D Laser Mapping uses unique market-leading technology to combat this problem.

When steeply sloping rock faces break into fragments and release rock debris, close fitting wire mesh and netting is often anchored to the slope face. Vegetation can take root and cause an obstruction to systems trying to measure movement on the slope face itself. SiteMonitor4D can work around these obstructions by using a unique function to record multiple targets for each measurement. This precise and high-accuracy laser ranging is based upon echo digitisation and online waveform processing. This technology, alongside the small footprint of LiDAR, enables measurements of the wire mesh (first target) and the slope (last target) to be returned. SiteMonitor4D software automatically filters these measurements so that only data from the slope face is analysed.

Unstable rock faces can be monitored extensively, without the need to compromise existing safety measures achieved through applying wire mesh or netting. "SiteMonitor4D can resolve rock fall accumulation and debris movement behind the mesh which can often indicate slope instabilities, even on slopes with over 60% of their surface covered in mesh" commented Dr Sarah Owen, LiDAR Systems Engineer at 3D Laser Mapping.

Monitoring through wire mesh doesn't have to be a nearly impossible, time-consuming task – a SiteMonitor4D system from 3D Laser Mapping can be used for automatic, accurate slope monitoring with ranges up to 4km away from the slope face.

If you want to carry out detailed, automated slope stability analysis and want to find out more – please get in touch via the contact details below. 3D Laser Mapping employs a team of monitoring specialists who would love to discuss your challenges with you.

Visit our website: [www.3dlasermapping.com](http://www.3dlasermapping.com)

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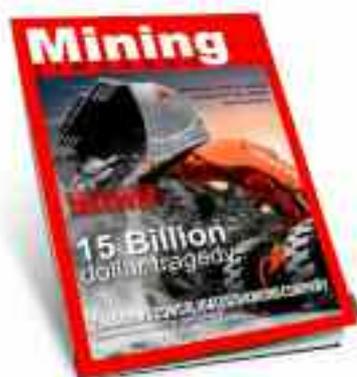
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**Using technology to reduce risk of fatigue-related incidents on the jobsite**

# Fighting fatigue

When a person is fatigued, the operation of heavy machinery or hand tools can become very dangerous. "A fatigue-related incident is more severe than a non-fatigue related incident," said Todd Dawson, Project Manager for Cat Safety Services, at a recent Caterpillar trade press event. "People that fall asleep when they're operating equipment or vehicles, they don't do anything. They just run into whatever's in front of them or run off the edge at whatever speed they're going. A drunk driver, they'll swerve. They just swerve too late or they put on the brakes. They just don't put them on quick enough."

So, what is fatigue and what causes it? "Fatigue is the state of feeling very tired, weary or sleepy resulting from insufficient sleep, prolonged mental or physical work, or extended periods of stress or anxiety. Boring or repetitive tasks can intensify feelings of fatigue."

Acute fatigue results from short-term sleep loss or short periods of heavy physical or mental work, and is of short duration and can usually be reversed by sleep and relaxation. Chronic fatigue syndrome is a constant, severe state of tiredness that is not relieved by rest.

The first factor to address is changing the culture around fatigue, fostering a work environment where fatigue is not seen as weak, shameful or a disciplinary problem. In addition to addressing attitudes, workers also need to understand their own limits and fatigue concerns. Many workers think that they're getting more sleep than they actually are – a worker might say and think that they got seven hours, when in actuality they got far fewer.

To help workers understand their own fatigue concerns so that they can be addressed, and make the jobsite safer, Caterpillar has developed two technologies.

Smartband monitors quantity and quality of sleep

The Caterpillar Smartband is a wrist-worn safety technology that measures quantity and quality of sleep and provides the wearer with real-time visibility to their fatigue level. According to Sal Angelone, Fatigue Solutions Consultant at Caterpillar, the Smartband collects and analyzes movement data to identify quantity of sleep, quality of sleep, and timing of sleep and wake cycles for individual users. He said that this data

"is further processed using a patented bio-mathematical predictive model to demonstrate the users' change in performance effectiveness over time. Effectiveness is based on sleep history and circadian time of day and is scored out of 100. A score of 70 or below indicates high levels of fatigue and [poses] a statistically significant increased risk of having a fatigue-related human factors incident."

According to Dawson, the Smartband is tough enough to withstand the rigours of the jobsite. It is designed to be low maintenance and battery life lasts up to 60 days to ensure that workers won't have to remember to charge it on a frequent basis.

The Gen 1 Smartband is used primarily as an assessment tool, rather than for real-time feedback to the supervisor, but there are plans to expand its capabilities.

Caterpillar Safety Services is currently reviewing a Gen 2 band which is designed for real-time monitoring and predictive monitoring. Like the Gen 1 band, the Gen 2 band will allow the wearer to see a real-time effectiveness score. With the Gen 2 band, the supervisor will be able to review current

# Fighting fatigue

*Using technology to reduce risk of fatigue-related incidents on the jobsite*

effectiveness scores as well as predictive scores – what an individual's score might look like near the end of the shift. Angelone said that this visibility will allow supervisors to focus on risks within shifts.

Privacy of users' data is a concern addressed by Caterpillar. Dawson said that all data is kept confidential and pooled together by Caterpillar to be provided to management as a group data set. A Caterpillar Safety Services expert can then contact an individual to discuss their findings and confidentially address specific fatigue concerns. The data can be used to flag sleep problems, such as sleep apnea, which contribute to fatigue. When the anonymous compiled data is sent to management, they can use modelling tools to analyze the data, looking at productivity, absenteeism, turnover, health care cost and more to measure the global impact of fatigue.

## In-cab driver safety system

The second piece of technology that Caterpillar is offering to combat fatigue is the in-cab Driver Safety System (DSS). When installed in a vehicle, the DSS camera faces the operator and monitors facial characteristics. It looks at eye closure duration and head pose by measuring 24 points on the driver's face. When an event is detected, the system sounds an audible alarm and rumbles the seat. Fatigue events are logged and sent to a Caterpillar data centre to classify and confirm the event. Caterpillar experts analyze the data and provide recommendations to the organization.

In addition to making the jobsite safer, there is indication that reducing fatigue can reduce wear on equipment. Dawson said that with the DSS in place, one group saw a 13 percent reduction in some vehicle codes – such as hard shifting, abusive shifts, hard braking, driving with the truck body up and so on. Currently, the most common application where DSS is in use is in haul trucks on mine sites.



**The Gen 1 Smartband.**

## Changing the workplace culture

"We have to do a few things to make sure people actually accept [the technology], and use it properly," said Dawson. "So we have a formal

– which often results in tampering events. When introducing new technology such as the DSS to the jobsite, Dawson said there is a significant drop-off in tampering when transparency and education

**“It looks at eye closure duration and head pose by measuring 24 points on the driver’s face”**

system of change management where we go and provide information to the people who are going to be exposed to that technology. We set up some policies, procedures around what's going to happen with the data, what we are going to do if someone has a fatigue event or they are at high risk."

Caterpillar Safety Services does on-site training on the use of the Smartband and DSS, and on the attitude toward safety within the organization. When a new piece of technology, especially a camera, just shows up on a jobsite without explanation, workers can understandably become suspicious

accompanies the technology.

Caterpillar Safety Services Leadership Workshops cover fundamental principles for fatigue risk management and present strategies to reinforce a workplace culture that is committed to eliminating risk and complacency surrounding fatigue.

"The notion that you can eliminate fatigue is not realistic," Dawson said. "As long as you have people driving long hours, working through the night, odd shifts, they're going to get tired, but if we catch it, we can mitigate it and manage it."

# Remote monitoring of underground Mining equipment

## Introduction

Underground mining is a complex task which takes place in hostile environment that has been around since times immemorial. The underground mining industry uses a wide variety of machines. These machines range from earth movers, and dumpers, to diesel generator sets for backup power. The industry will grow to be a \$24 billion market by 2019 reports Technavio, with the APAC region contributing the largest chunk to the revenue.

This means that we have a huge industry which is completely unaware of how their equipment are being used, when they require maintenance, and the effects that the surrounding conditions have on them. Needless to say, a remote monitoring solution is the best option for mine owners and operators to make informed business decisions, and increase their operational efficiency.

## Problems with underground mining

Underground mining is not an easy job. There are a wide variety of issues, some of which are:

### Productivity issues

The following issues cause loss in productivity either in terms of mining or in terms of:-

### Downtime

Engine health issues and breakdowns cause equipment to be left standing idle causing loss in productivity. While equipment downtime has multiple reasons, most of them are avoidable in nature.

### Operator inefficiency

Operators are inefficient either because of lack of training, unfamiliarity with the equipment, or in extreme cases due to laziness. Operator inefficiency can have more serious repercussions for the people working in the mine.

### Operational leaks

Operational leaks are issues that increase the operational overheads of the



Fig. 1: Architecture of the solution

mine. This ends up encroaching on the profits generated.

### Fuel thefts

Fuel thefts plague a lot of mines throughout the world. The easiest way to steal fuel is to fill less than expected. In extreme cases, fuel is siphoned after it has been filled.

### Skewed liter per hour consumption ratio

Old, abused, or unmaintained equipment ends up consuming more fuel as compared to the output given. This is another form of operational leak that can be plugged easily.

### Equipment abuse

Equipment abuse happens due to young or untrained operators. Unfamiliarity with the equipment also causes abuse to the equipment. Thankfully, this can be easily remedied by proper training and guidance.

### Miner safety issues

Underground mines are present dangerous working conditions for miners. Fatigue and stress can cause accidents that result in loss of life.

### Digging conditions

Underground mines are hot and humid places, full of toxic chemical gases. The equipment faces a high degree of vibration and consequently, wear and tear. Needless to say, underground mines exhibit some of the harshest working conditions.

### How the solution should work

An ideal solution would consist of a single device that could fit on the equipment without taking up too much space. This device should get inputs from the Engine Control Unit (ECU). Once the device is installed, it will get various values of speed, fuel, temperature etc. for the remote monitoring. as Internet connection won't be available the device needs to have internal storage to store data received from the equipment on the board itself.

However without Internet connection fetching the recorded data and uploading it to a cloud application is not an easy task. In order to upload the data, a wireless technology that does not depend on Internet will have to be used. The most feasible communication will be RF based. Thus when a user goes near the device with a Hand Held Unit (HHU), the device should automatically transfer all the stored data to the HHU. There are two ways to go about this, namely:

### BLE based data fetching

The device would have a Bluetooth Low Energy (BLE) module attached in order to transfer data. A special BLE based mobile application would turn any normal smartphone into a HHU. When the user goes near the device with the mobile phone, the device will auto-connect and transfer the data of the equipment to the mobile phone. Once the mobile phone establishes Internet

# Remote monitoring of underground Mining equipment

connection via either GPRS or Wi-Fi, the application will automatically upload the data to the cloud application.

## RF based data fetching

RF bands especially the Sub1 GHz band, is a high range, high penetration band. The monitoring device that is installed on equipment can have a RF trans-receiver to transmit data collected by the device. When a person enters a mine with a RF enabled HHU, the data from the devices can be collected automatically. The HHU can be a customized hardware device, or it could be a mobile phone, with a small protocol convertor that can be attached to it.

The RF based solution can also use a Data Concentrator Unit to automatically collect data at given intervals. The solution will need multiple signal repeaters in order to cover devices that are far away, and whose data cannot reach the DCU.

## Conclusion

Underground mining uses a wide variety of equipment, and remote monitoring them is a logical step for mine owners and operators. Remote monitoring will help not only with increasing the profits via informed policy decisions, but also reduce instances of accidents, and loss of life and productivity. With the mining market growing at astonishing rates, a robust, reliable, and field-tested solution can make all the difference.

# Metallon Corporation



## Q2 2016 Production and Corporate Update

Metallon Corporation, the gold mining, development and exploration company with producing assets in Zimbabwe and exploration assets in Tanzania and DRC, announces its production results for Q2 2016 and an update on corporate activities. These results are unaudited and are therefore subject to final adjustment.

Group gold production for Q2 2016 was 22,565 ounces, 9% higher than the previous quarter (Q1 2016: 20,673). Production for the year to date of 43,238 ounces. The increase in gold production in Q2 2016 was mostly due an outstanding performance at How Mine.

Power interruptions continued to affect operations in Q2 2016. Metallon lost 112 hours of production in Q2 2016 which equates to approximately 1,700 ounces (Q1 2016: 4,275 ounces). Metallon is working on possible solutions for supplementing grid power supply.

The Q2 2016 Group C1 costs were US\$764 per ounce and all-in-sustaining costs ('AISC') were US\$971 per ounce. This is an improvement of 14% and 16% compared to Q1 2016 (Q1 2016: C1 cost US\$884 and US\$1,156). This improvement was the result of increased production and cost

savings from overtime control and central procurement. As production and cost efficiencies improve throughout the year with new equipment and increased capacity, Metallon expects these costs to reduce further.

In Q2 2016 development metres drilled were 3,871, a 26.5% increase on 3,059 metres drilled in Q1 2016.

Group Expansion Update:

### How Mine

How Mine has commenced the deepening of the 16N7 Shaft in order to increase ore supply. The shaft deepening from 28L to 34L is to access ore below 28 Level which will increase future production. Commissioning of the deepened shaft is expected in 2018.



### Shamva Mine

The new Tailing Storage Facilities ('TSF') at Shamva Mine will be commissioned in Q4 2016. Plans are scheduled to refurbish the Processing Plant at Shamva Mine to 70,000 tonnes per month capacity, which would increase production in 2017. In Q2 2016 Management appointed contract miners at Shamva Mine. Contract miners commenced on 1st August 2016 and management are confident that positive results will be generated in Q3 2016. Dependant on performance, management may consider use of contract miners across the Group.

### Mazowe Mine

Construction on the new Processing Plant and TSF at Mazowe is currently at 80% and commissioning is expected in Q4 2016. The new Mazowe Processing Plant will increase capacity

# Metallon Corporation



## Q2 2016 Production and Corporate Update

at the mine to 70,000 tonnes per month.

### Redwing Mine

Redwing Mine continues to increase production following the resumption of operations in November 2015. Production is expected to increase to 22,000 tonnes per month by Q4 2016. Plans are also underway to increase production to 50,000 tonnes per month in 2017.

### Group Exploration

Exploration drilling has commenced at Mazowe Mine and drill results will be published in Q3 2016. Metallon's next MRM Group statement as at 30 June 2016 will be available in Q3 2016 and will include additional resources at Redwing Mine following the resumption of mining. In 2016, Metallon will be focused upgrading the Inferred section of its resource into the Measured & Indicated category. This exploration programme across Metallon's mines is positioning the Company for increased production over the next five years.

Ken Mekani, Chief Executive Officer, Metallon Corporation, commented; "Metallon delivered a positive performance in Q2 2016. Production increased almost 10% and AISC reduced by 16% quarter on quarter, with the operations at How Mine especially achieving strong results. The New Processing Plant at Mazowe is 80% constructed with all key equipment on site and we have confirmation from our contractors that the Plant will be commissioned in Q4 2016. The appointment of contract miners at Shamva Mine and ramp up at Redwing Mine will also provide increased production in the second half of the year.

We look forward to the continued expansion across the Group and reaffirm our production target of 120,000 ounces in 2016." "Metallon is currently investing



### Q2 2016 Production Highlights:

Mine	April production (oz)	May production (oz)	June production (oz)	Q2 2016 production (oz)	Q1 2016 production (oz)
How	3,578	4,717	4,436	12,731	9,540
Shamva	1,694	1,728	1,507	4,928	5,063
Mazowe	977	826	736	2,540	2,902
Arcturus	0	0	0	0	788
Redwing	873	740	753	2,366	2,379
<b>TOTAL</b>	<b>7,122</b>	<b>8,011</b>	<b>7,432</b>	<b>22,565</b>	<b>20,673</b>
Group C1 costs (\$/oz)	770	729	749	764	884
Group C3 (\$/oz)	1,069	967	915	983	962
Group AISC (\$/oz)	1,066	954	908	971	1,156

significantly in Zimbabwe with the deepening of the shaft at How Mine, the refurbishment of the Processing Plant at Shamva Mine, the expansion at Redwing Mine and a targeted exploration programme across the Group. This large capital expenditure programme over the next few years will considerably increase our production and generate future revenue. Mining is viewed as one of the fundamental pillars of economic growth and development in Zimbabwe. Although the initial on-set of liquidity challenges impacted mining activities due to delays in paying for imported products, we are encouraged that the Reserve Bank of Zimbabwe is prioritising payments within the mining sector. Metallon continues to work closely with the Chamber of Mines and we are engaging regularly with the Ministry of Finance and the Ministry of Mines and Mining Development."

# RIOZIM Limited Abridged reviewed group results

## Introduction

The Group has continued to make progress and returned to profitability at an operating level during the first six months of the year. Gold production went up by 76%, production costs decreased by 19% and average gold prices firmed by 16%. This has resulted in the operating results of the Group swinging from an operating loss of US\$2million, in the comparable period last year, to an operating profit of US\$2.3million.

Significant investment has been made in the gold businesses including the new Cam & Motor gold project. Empress Nickel Refinery (ENR) has remained under care and maintenance due to unavailability of raw material.

## Economic Overview

Major policy changes were announced during the period. Some of these were aimed at addressing the liquidity constraints in the country which have been worsened by continued deindustrialisation and subdued export receipts. Clarity was given by the Government on the indigenisation regulations, creating a better framework for compliance.

Export incentives of 2.5% to 5% were introduced and these were to be funded by the introduction of bond notes. Import of certain commodities was restricted through Statutory Instrument 64 (sixty four) of 2016.

Whilst Nickel and Copper prices continued to fare badly, gold prices have recovered since end of January 2016 and appear to be stable.

## Group Performance

Driven by the nearly doubling of gold production and coupled with an improvement in gold prices, the Group's revenue increased by 40% to US\$32.6million compared to US\$23.1million during the same period last year. The Group posted an operating profit of US\$2.3million.

## Group Treasury

The Group's finance costs fell by 46% to US\$2.5million against US\$4.7million recorded in the same period last year. The Company is current on all its obligations.

## Gold businesses

Gold production, at the recently re-opened Cam & Motor Mine of 405kgs surpassed that of Renco Mine at 370kgs bringing total production to 775kgs compared to 441kgs in the same period last year. The initiatives to cut production costs at the end of 2015 improved the blended all in cost of production in the first half of 2016 by 19%. We are continuing to cut costs and believe we can reduce them by another 15% on a blended basis.

## Base Metals

ENR remained under care and maintenance due to unavailability of matte supplies from the current sole supplier. The latest indications are that the matte supplies will resume in 2017 from either the current supplier or through alternative matte suppliers. Meanwhile care and maintenance costs were reduced through the redeployment of employees to the nearby Cam & Motor operation. Other initiatives to secure raw material to resume operations at the Refinery are in progress.

## Chrome

The Chrome project was put on hold awaiting chrome prices to firm up which should facilitate initiatives to raise funding to commence operations. The situation will continue to be closely monitored.

## Energy

Investor appetite for the Sengwa Power Project has improved. The Bankable Feasibility Studies (BFS) for both divisions of the Project, namely the mining of coal and the power generation project were updated. This has enabled the company to have meaningful discussions with potential investors. Stakeholders will be kept informed of any firm developments regarding this project.

## Diamonds – Associate ( Murowa Diamonds (Private) Limited)

Significant funds were invested at Murowa Diamonds (Private) Limited towards stripping waste in line with the new mining plan and towards expanding plant capacity. Given the amount of tonnage to be stripped and the massive

costs related to this exercise, the Board of Murowa Diamonds (Private) Limited decided to introduce owner mining which brought in big cost savings. This required investing further funds to acquire Heavy Mobile Equipment. These investments were done and significant progress was made in implementing the new mining plan. As a result, the loss position of the Associate is 65% better than the same period last year. More investment is being made to further expand its plant capacity and to extend its Life of Mine.

## Outlook

The Group's focus during the second half of 2016 will be on the completion of the Cam & Motor Plant Project which is expected to be commissioned in the fourth quarter. The successful completion of the project is expected to result in the current gold production at Cam & Motor increasing two fold and production costs decreasing further. The Group will continue its cost reduction drive and expansion of the gold business through exploration and potential acquisitions. Whilst securing matte and resumption of operations at ENR is of high priority, the current depressed base metal prices remain a factor that continues to be of concern to the base metal industry. Management will continue to explore all the available options for this operation to resume production.

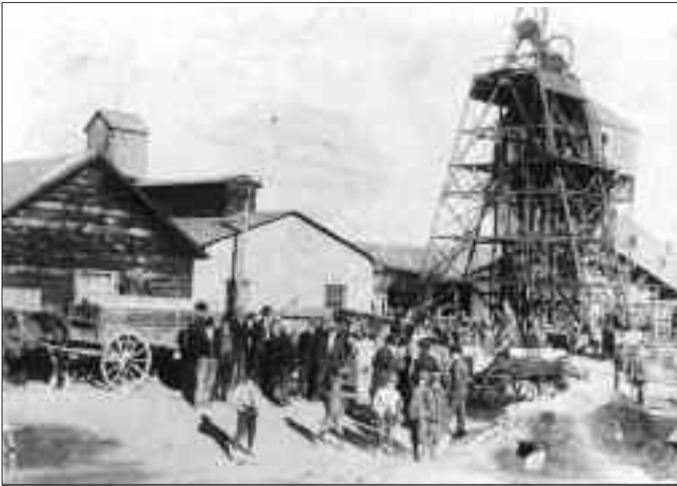
## Sustainability

The Group remains committed to building and maintaining sustainable development to ensure that socio-economic benefits are afforded to the communities in which the Group operates through the RioZim Foundation. A number of community projects were carried out during the first half including provision of community subsistence, installation of a borehole at ENR, education assistance and construction of a classroom block at Magee Primary School in Gokwe North including furnishing of desks and chairs.

## LP Chihota

Board Chairman  
Harare

# Seven Safety Tips to Reduce MINING ACCIDENTS



File image: Wankie (Hwange) coal mine disaster 1972

Working in mining is risky business. Wankie coal mine disaster took place on 6 June 1972 when a series of underground explosions occurred at the Wankie No.2 colliery in Wankie (now known as Hwange). With 426 fatalities, it remains the deadliest mine accident to date in the country's history. This year an accident at a coal mine in southwest China claimed 22 lives. In fact, China has some of the most dangerous mines in the world, and authorities have scrambled to try to enforce safety rules. If you're considering a career in mining, or you are a miner it is crucial that you take the following safety measures to keep your time in the mines as trouble-free as possible.

## 1. Don't Ignore the Danger

The first step toward keeping yourself safe is to be cognizant of the fact that working in mining is hazardous. Accept that the mining industry is inherently filled with danger and stay alert every moment on the job. Watch out for your colleagues as well and never let your guard down. Accidents with major impact can occur in a moment of carelessness.

## 2. Dangerous Tasks Require Planning and Communication

When planning tasks, don't think only of completing them as efficiently as possible. Allocate extra time and money for safety requirements. Never compromise the safety of your employees when trying to meet deadlines or to boost the quality of work. All risks should be assessed, including the possibility of accidents. Try to eliminate risks as much as possible. Where a risk still exists, provide your team with clear instructions and educate them on how to mitigate it. If necessary, deal with the danger should it arise.

## 3. Get Professional Training

All team members should undergo regular safety training. This should not just apply to new team members. Even long-standing employees should be made to attend refresher courses. Safety training sessions that contain

theory and practical components can be very helpful. Workers who take on strenuous roles may be sent for health and fitness checks to determine whether they are able to take on the physical demands of their work.

## 4. Always Wear Safety Equipment

There is a litany of safety equipment that mining workers use for their protection, from helmets to safety glasses and gloves. It is essential that all workers wear the necessary safety equipment at all times. There have been countless stories of workers being saved by helmets, for example.

## 5. Supervise Your Team

All team members should follow safety instructions with no exceptions. A supervisor must also be diligent about following up and enforcing the rules. Never allow more people to enter a site than are allowed. Supervisors also need to know the whereabouts of all team members throughout each shift. Likewise, all workers should be kept informed about what their fellow team members are doing throughout the day. Never allow any team members to breach the safety rules without a warning or, in the case of repeated disobedience, appropriate consequences.

## 6. Document Your Safety Procedures

When accidents happen, all team members should know exactly what to do. Safety procedures must be clearly defined. When documenting the safety procedures, describe the various incidents that might occur, what needs to be done and whom to contact. Safety procedures should be displayed prominently in locations that can be easily accessed by team members.

## 7. Follow the Latest Safety Standards

Ensure all safety equipment is serviced regularly and satisfies all the latest safety standards. Never try to save on safety equipment. If an item no longer complies with the current safety standards, replace it, even if this means increasing expenses or delaying a project. Never allow staff to use outdated safety equipment, even for a short period of time.

The number of safety-related incidents in the mining industry is high. Unfortunately, some of the tragedies that have occurred could have been prevented. Don't repeat the mistakes that have been made by others. While the risks can never be eliminated completely, following the above tips can help significantly.

# Original Caterpillar BELTS

As a global leader for over 85 years, Caterpillar belts provides the highly competitive technology and options suitable to be used on products for all industries we support. Caterpillar Belts are manufactured and tested for ideal traction, speed and long service life on Cat machines to prevent slippage and alignment problems.

## TYPE BELTS

**Caterpillar V-Belts (also referred to as "Vee Belts") – Cogged**

**Caterpillar V-Belts – Non-Cogged**

**Caterpillar Serpentine Belts**

**Caterpillar Banded – Cogged**

**V-BELT MAINTENANCE TIPS**

- Check for cracked, worn, or frayed belts. On matched belt sets, always replace the complete set. If just one belt is bad, uneven load on belts, pulleys, bearings, and shafts can occur.
- Check pulley grooves to make sure they are not worn, damaged, or aligned incorrectly. Poor belt to pulley contact will result in rapid wear and short life.

With well over 900 Caterpillar belts from which to choose you can be certain we have the right belt for your machine.

115-2459 Cogged V-Caterpillar Belt

C838377 Caterpillar Belts

V-BELT SIZING GUIDE

Belt size refers to the pulley groove width (B) for belt under and equal to ½ in.

Belt size refers to the belt top width (A) for belts over ½ in.

BELT SIZE/BELT	TOP WIDTH	PULLEY GROOVE WIDTH
9.6mm (3/8 in)	10.72mm (0.422 in)	9.65mm (0.380 in)
12.7mm (1/2 in)	13.89mm (0.547 in)	12.70mm (0.500 in)
17.5mm (11/16 in)	17.48mm (0.688 in)	15.88 mm (0.625 in)
19.1mm (3/4 in)	19.05mm (0.750 in)	17.53mm (0.690 in)
22.2mm (7/8 in)	21.51mm (0.847 in)	19.94mm (0.785 in)
23.8mm (15/16 in)	23.83mm (0.938 in)	22.30mm (0.878 in)
27.0mm (1 1/16 in)	26.97mm (1.062 in)	25.48mm (1.003 in)
31.8mm (1 1/4 in)	32.94mm (1.297 in)	31.83mm (1.253 in)

SAE EFFECTIVE LENGTH FOR COG AND NON-COG Caterpillar BELTS EQUALS:

*Outer circumference minus 9.65mm (0.38 in) for 3/8 inch and 1/2 inch belt sizes.*

*Outer circumference minus 14.48mm (0.57 in) for 11/16 inch and larger belt sizes.*



Safe measurement, indication and control of rotational speed



## Universal speed measurement for explosive areas Hand-tachometers = RHEINTACHO



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# PRODUCE YOUR EIA

## Your right to a clean safe and healthy environment



An Environmental Impact Assessment (EIA) is a process which identifies the impacts of a development project and clearly outlines measures to mitigate the negative impacts while at the same time enhancing the positive impacts. The Environmental Management Act defines an Environmental Impact assessment as 'an evaluation of a project to determine its impact on the environment and human health and to set out the required environmental monitoring and management procedures and plans'. The EIA is thus a tool that enhances sustainable development where environmental, economic and social issues are mainstreamed in the project in a balanced manner.

In Zimbabwe, the projects that need environmental impact assessments are listed in the first Schedule of the Environmental Management Act (Cap 20:27) and they include mining, quarrying, housing developments, ore processing among others. The importance of the EIA process lies in its ability to direct project studies and address environmental impacts before they occur based on the "precautionary principle." EIA is a tool to achieve the desired balance between development and environmental protection.

EMA plays a facilitative role in as far as the EIA process is concerned. The Agency has reduced EIA fees for all prescribed projects with effect from December 1, 2015 in the interest of the ease of doing business in the country. The EIA fees have been reduced on a sliding scale based on the impact of each developmental project on the environment. Furthermore, staggered payments can be done on each stage of development of the project as shown:

### Environmental Impact Assessment Fees Adjustments

Project Category	Old EIA Fees	New sliding scale fee	Level of environmental and social impact and example of projects	Staggered Payment terms of EIA (% project costs)		
				Upon EIA submission	Upon Implementation	During implementation
A	1.5% of project cost	US\$210.00	Small scale projects with minimal impact: small scale mining, small scale infrastructural development projects, SMEs etc	100%	nill	nill
B	1.5% of project cost	0.8% of the project cost	Moderate impacts e.g. Tourism infrastructure, commercial brick moulding, housing development etc	0.26%	0.26%	0.28%
C	1.5% of project cost	1% of the project cost	High negative impacts e.g. commercial entities, manmade lakes etc	0.33%	0.33%	0.34%
D	1.5% of project cost	1.2% of the project cost	Extremely High negative impacts e.g mining, ore processing, chemicals plants, tanneries, oil and gas exploitation. Impact can continue after decommissioning e.g. acid mine drainage	0.4%	0.4%	0.4%

An EIA is a tool that does not inhibit but enhances development. The new fee structure is aimed at boosting sustainable investment in the country as we endeavor to balance environmental, economic and social components in a growing economy. So why wait to regularize your operations?

# **MANITOU** HANDLING YOUR WORLD

## **MANITOU ROOF BOLTER**

*An automated drill and bolt rig offering manoeuvrability and performance in confined soft and hard rock hanging walls as low as 1.8 metres, the Manitou ROOF BOLTER consists of a single rotating carousel head, which carries six roof bolts, and enables drilling, automatic epoxy injection and bolting functions in a single procedure.*



## **MANITOU SCALER**

*The Manitou Scaler enables operators to scale hard and soft rock from secure area on its seven metre, 180 degree rotational turret, either from within its fully-enclosed cab, or from up to 20 metres away via remote control for maximum safety. Secondary functions include pipe and cylinder fitment, mesh erection and the destruction of large rocks.*

## **MANITRAX TOW TRACTOR**

*Designed for transporting and towing equipment, tools, skids and tanks, the ManiTrax utility vehicle combines exceptional hauling capabilities with maximum manoeuvrability, including full four-wheel drive and crab steering functionality allied to sleeker, more compact exterior designs. The flexibility of the vehicle design enables wide scope for modifications and optimisations for a variety of applications, including 1.5 ton crane to enhance loading and unloading functions.*



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# Superior Valor Vertical Shaft Impactor for rates up to

# 800 tph



Superior Industries Inc., a U.S.-based manufacturer and global supplier of bulk material processing and handling systems, is introducing their new patent pending Valor Vertical Shaft Impactor (VSI). The VSI is Superior's second equipment solution for crushing bulk materials after launching the compression-style Patriot Cone Crusher late last year. Impact style crushers, like the Valor VSI, produce a more cubically shaped product.

Incorporating criteria from several of its existing customers, Superior says its engineers produced a stronger, safer and more convenient design. For example, the VSI is equipped with a cartridge style, right angle pinion gearbox. This allows for a safer deck-mounted motor arrangement, which also simplifies access to the drive and its components. In addition, a hydraulically powered lifting lid allows for safe and easy access to the crushing chamber. Maintenance inspectors are protected by a combination of automatic and manual safety interlocks. Thirdly, an innovative autogenous rotor design encourages more rock on rock crushing, which greatly extends the life of many internal parts.

Superior manufactures models of its new Valor VSI for rates up to 800 tph (725 mtph) and maximum feed sizes up to 8 inches (203 mm).



# Articulated dump trucks are getting larger, safer and more productive

The articulated truck market has changed considerably over the last 20 years. "Twenty years ago the most common size was a 25-ton articulated truck and as you got bigger, they were less in-demand. And now that's flip-flopped completely so there are more 40-ton units coming into the marketplace each year than any other size," says Brian Bereika, ADT Product Specialist for Doosan, who has been directly involved with articulated trucks since 1994 and has seen the changes first-hand.

"The people who were using 25-ton [ADTs] moved up to the 30-ton, and the 35-ton users went up to 40 and above, so there are only two predominant sizes in the marketplace now, 40-ton and above, and 30-ton," he adds. "The 35-ton market is so small that several manufacturers have dropped out of it. The 30-ton and 40-ton account for over 75 percent of the whole market."

The 25- and 30-metric-ton-size classes still maintain a strong place in the market, says A

Product Marketing Manager, ADTs for John Deere. "We're finding there are customers that will always stay in that size class just based on the needs of maneuverability, the size of the jobsite and the price point of those trucks. Customers obviously need to match their trucks to the loading tools that are already in their fleet as well."

A Senior Product Specialist at Caterpillar, says that they are seeing an upward trend on the 31-ton-capacity Cat 730C. "It's a nice, powerful machine but yet easily moveable from jobsite to jobsite, more on the rental side. The 730C and the [45-ton-capacity] 745C are our two top models."

"When you get to 50 and 60 tons, you're looking at huge sand and gravel operations or light mining," "and you're trying to go after some of the smaller rigid frame truck business, the 40- to 60-ton-size rigid frame – they're trying to replace some of those."

Volvo recently moved into this large-size category but with a choice of 6x4- or 6x6-drive articulated

truck. "We have continued to see growing demand for an increase in size and capacity of articulated haulers, [which] is why Volvo created the A60H, a 60-ton capacity machine and our largest hauler to date," says a, Product Manager, General Purpose Equipment, Volvo Construction Equipment.

Bell Equipment showed a prototype of their 60-ton B60E truck at Bauma 2016. It is expected to be available later this year. The first generation model, the B60D, was introduced in 2013. It was only available in Africa where it has been running successfully on various sites and gained popularity for its all-weather suitability. According to Bell Equipment Product Marketing Manager Tristan du Pisanie, the B60D adopted the two-axle concept of a rigid truck but with a driven front axle and independent front and rear chassis.

*The ADTs of today are safer, easier to operate, more comfortable, & available in larger models than 20 years ago, which can improve productivity – all important considerations when renting or buying.*



# Cat 992K

## Wheel Loader's Latest Updates Advance Efficiency, Safety and Uptime

Designed to lower fuel costs and increase operating efficiency, the recently updated Cat 992K Wheel Loader features Caterpillar's Economy Mode operation. With the new On-Demand Throttle arrangement, the 992K auto-matically manages engine speed, combining the efficiency of a manual throttle with ergonomic throttle lock operation.

Caterpillar performance studies have shown the 992K reduces fuel consumption by as much as 21% compared to the previous model series.

Production-matched to deliver efficient 3-pass loading of the Cat 775 and 4-pass loading of the Cat 777 trucks, the 992K now offers Cat Production Measurement (CPM), the advanced payload weight measuring system. CPM promotes cost-effective hauling by helping loader operators minimize truck under-loading and overloading.

Several new features of the updated 992K enhance operating safety. The loader is built fire suppression ready, which simplifies installation

and provides system integration to enhance reliability. Fall protection tie-offs provide fall arrest for service technicians when working on the loader. The 992K design includes turn signals and hazard lights, a bi-directional emergency gate, wheel chocks and mid-rails for enhanced safety when cleaning windows.

New performance enhancing features boost uptime and productivity. Pump efficiency monitoring improves hydraulic system responsiveness, improved fluid filtration boosts reliability, and coolant loss monitoring increases uptime. Cat Advansys™ G.E.T adapters maximize loader uptime by offering fast, hammerless installation and removal of ground engaging tools.

Inside the 992K cab, joystick controls provide low effort, sure operation of implements. The updated information display includes a color graphical touchscreen for intuitive machine operation. A common mining cab design for

Caterpillar's four largest wheel loaders and two largest wheel dozers helps ensure parts

availability and helps keep inventory costs down.

The 992K offers several design features to reduce service time. Centralized service centers and ground level access points, including the bumper service center and fluid service center, speed up service and reduce exposure to falls. The Vital Information Management System (VIMS™) continually monitors machine health and provides operators, service personnel and fleet managers operating information across a wide range of critical loader functions.

Offering a net 801 horsepower (607 kW) rating, the Cat C32 ACERT™ engine powers the 992K. Depending on regional needs, it can be configured to meet U.S. EPA Tier 4 Final/EU Stage IV or U.S. EPA Tier 2/EU Stage IIa emissions regulations. The loader's 14-16 yd<sup>3</sup> (10.7-12.3 m<sup>3</sup>) bucket capacities offer a standard lift payload of 24 tons (21.7 tonnes) and 21-ton (19.1-tonne) high lift payload.



# Doosan DX190W-5

## Wheeled excavator is an ideal solution for a range of jobs

When you need big-time productivity in a machine that's easy to transport and maneuver, turn to the Doosan DX190W-5. It's ideal for public works departments as well as highway and utility contractors, subdivision and commercial developers and industrial firms with large, spread-out facilities.

Its modular design allows you to easily configure the machine's undercarriage with a dozer blade or outriggers to be mounted on either end of the machine. The dozer blade can be used for leveling or backfilling material, or stabilizing the machine during digging applications. The blade's large dozer bottom and parallel design minimize ground pressure. Outriggers can be individually controlled in order to level the machine on slopes. The DX190W-5 can be ordered with either a one-piece or two-piece boom.

The Electronic Power Optimizing System (EPOS) deliver optimum power and fuel efficiency. The design optimizes combustion and torque for faster cycles and maximum results. Four work modes, auto-idle and machine diagnostics help you manage your fuel costs. Smart Power Control (SPC), when enabled, improves machine efficiency while maintaining productivity and reducing fuel consumption when you operate in Work Mode.

The front axle offers oscillates and provides an excellent steering angle for maneuverability but can be locked for better digging and lifting performance. The rear axle is fixed. The transmission is mounted directly to the rear axle for protection from obstacles and optimum ground clearance.

An advanced disc brake system works directly on the hub instead of the drive shaft to avoid planetary gear backlash. This eliminates the rocking effect associated with working free on wheels. The driveline allows more comfort when traveling thanks to increased smoothness and improved hydraulic retarding and gear shifting.

The wide side access doors make cleaning radiators and coolers quick and easy, while a large-capacity engine air precleaner removes more than 99 percent of airborne particles and extends filter cartridge service life. Arm grease points are centralized for easy access.

A standard 7-in. color LCD display provides helpful maintenance history and monitoring information. It also displays video from the rear-view camera, which is uniquely placed to give you better visibility. A hybrid screen mode enables you to see machine information and the camera at the same time.

A spacious cab means better visibility and more productivity. High-performance air conditioning, extra storage and an optional air suspension seat give you better comfort, while ergonomically-designed joysticks provide maximum operating comfort. Use the floor foot pedal to control two-way auxiliary functions. During long work days, you'll appreciate the reclining, height- and weight-adjustable standard suspension seat with a headrest and adjustable armrest. An emergency engine shutoff is conveniently placed at the seat base.

Enjoy reduced maintenance costs and extended machine life with the durable chassis, strengthened boom and arm assembly, and extended greasing intervals. Easily access the oil filter, air cleaner, fuel filter, radiators and other engine components. The centralized boom and arm grease points are grouped for easy maintenance. Monitor your Doosan heavy equipment and manage maintenance to reduce operating costs with Doosan Telematics.

To comply with Tier 4 emissions standards, the DX190W-5 incorporates a high-pressure common-rail (HPCR) fuel delivery system as well as cooled exhaust gas recirculation (CEGR) combined with a diesel oxidation catalyst (DOC) and selective catalyst reduction (SCR).

# Atlas Copco electric Portable air Compressor



## Features four preset flow and pressure selections

Atlas Copco Construction Equipment's XATS 900E electric portable air compressor features four preset flow and pressure selections to give contractors versatility and rental centres greater flexibility in their fleet offering for improved ROI.

Atlas Copco displayed the compressor Sept. 26-28 at booth 2121-N during MINExpo International.

The compressor features a high-efficiency 160-kilowatt WEG 22 motor. Despite the industry-wide focus on Tier 4 Final regulations, the XATS 900E's electric motor exempts it from emission regulations, so it's usable in any state, province or territory. In addition, the electric motor gives contractors a cost-effective alternative to traditional diesel-fuelled air compressors because electricity prices are less volatile than fuel costs. The XATS 900E operates at a very quiet 73 decibels – about the same as a vacuum cleaner – which allows contractors to work in noise-sensitive areas, such as near hospitals or schools.

Atlas Copco designed the XATS 900E for dependable operation and high-quality results. For example, its Star-Delta starter reduces the starting current protecting the compressor, and has no limits on number of starts. The compressor comes standard equipped with an aftercooler and water separator with fine filters to reduce moisture as well as oil carry-over in the output air, and bypass should non-filtered air be desired.

The XATS 900E features an easy-to-use digital interface, main breaker, sequence phase relay and external emergency stop button for simple controlling and monitoring of the unit. Operators can use the compressor's digital interface to set the air flow to one of the four preset flow and pressure ratings, which range from 879 to 906 cubic feet per minute at 100 to 150 psi discharge pressure. This essentially gives users four units in one, which allows rental companies to serve a wide range of customers with one machine, resulting in greater ROI.

Atlas Copco also designed the XATS 900E to be compact and robust. The compressor features a heavy-duty, galvaneel steel frame and enclosure, and with a footprint of just 44 square feet, it's easy to place at tight jobsites, such as a pit, factory or warehouse. The compressor's small, durable structure also allows users to stack two high and fit as many as nine units on a 53-foot trailer. This gives contractors and equipment managers a cost-effective option for transporting equipment. Additionally, operators can use it on nearly any type of surface because its frame does not require a concrete base. Atlas Copco also offers an optional dual-axle trailer for towing.

The XATS 900E's large doors provide full access to all maintenance and



The Atlas Copco XATS 900E compressor features a variable flow of 879 to 906 cubic feet per minute at 100 to 150 psi, giving contractors the convenience of one machine with multiple settings.

## Dimensions

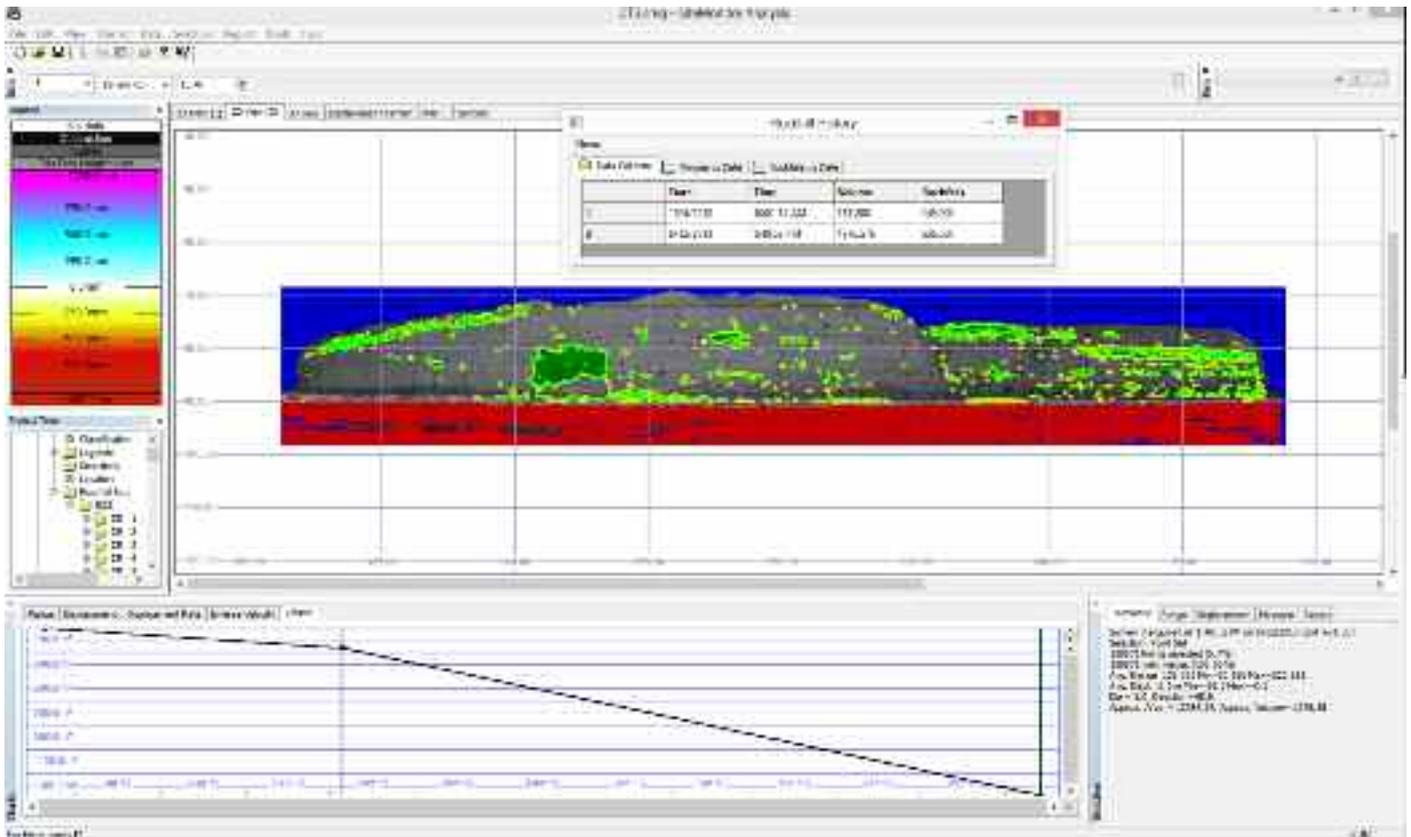


service points, all of which are on one side of the unit, to minimize servicing time. The unit also has a heavy-duty air filter that features a safety cartridge, which protects it from the elements to ensure reliability in any environment. Its 100 percent spillage-free frame will contain all of the compressor's fluids – diesel, both engine & compressor oils and engine coolant – if a leak occurs. This gives contractors peace of mind on environmentally sensitive projects.

# New IMPROVEMENTS to sitemonitor: rockfall analysis

Responding to a request from Anglo Platinum, 3D Laser Mapping released their first laser-based geotechnical monitoring system 'SiteMonitor4D' in 2004.

Designed to monitor and quantify changes to the rock face, SiteMonitor4D will automatically alert mine safety managers via email or SMS when issues arise. Such near real-time warnings enable critical safety-monitoring decisions to be made quickly and efficiently



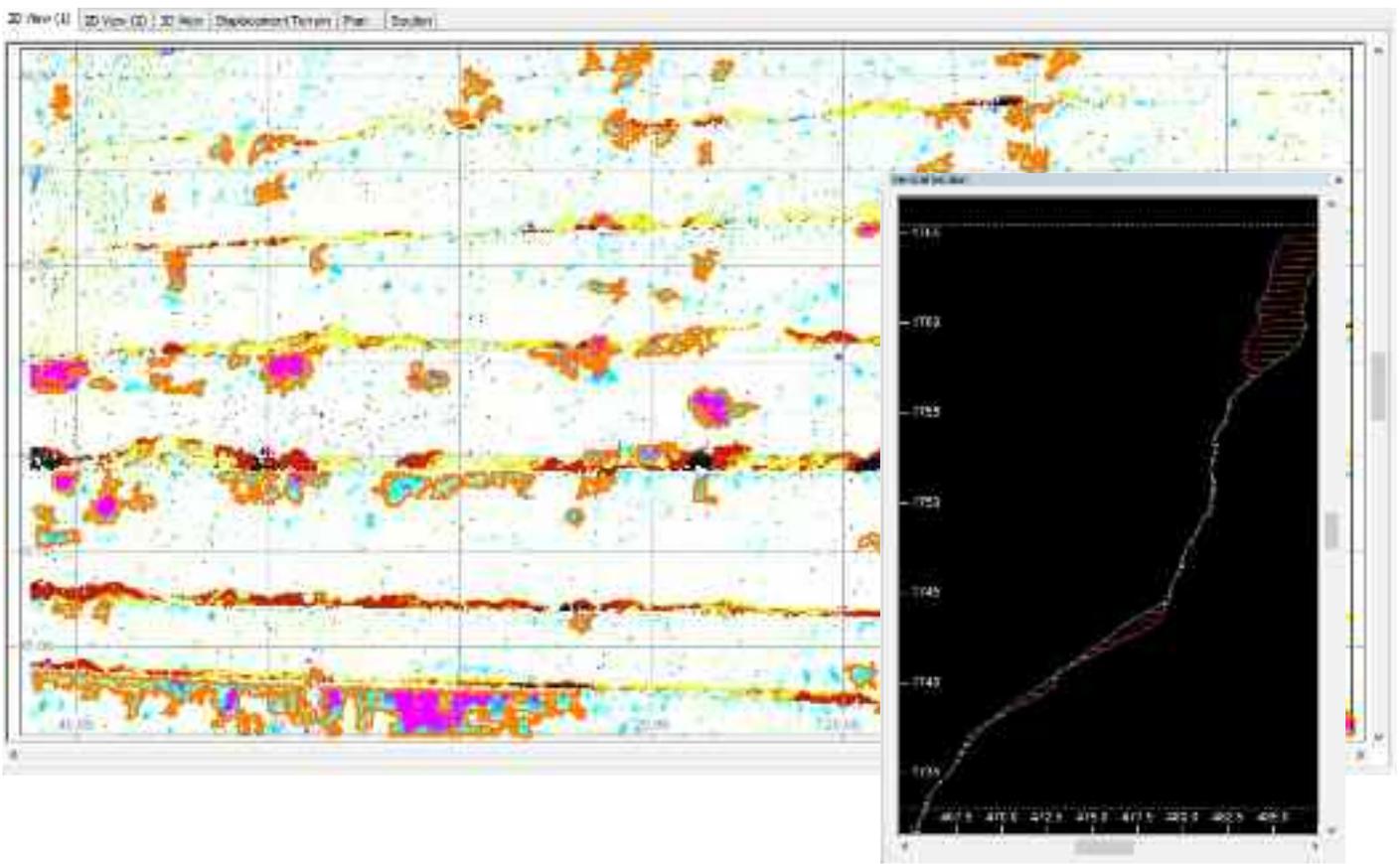
Since 2004, the range and resolution of commercial laser scanners have improved significantly which means we have the possibility to improve the failure prediction in the SiteMonitor software. 3D Laser Mapping began an innovative research project with Durham University in 2013 exploring the benefits of using rockfall analysis as a predictor of failure.

Based on the results of a project where laser scan data was collected for 100,000 square metres of coastal cliffs over an 8 year period. The resolution of the scan data was 0.01m and the volume of all the rockfalls (small and large) were quantified by volume. The smallest detectable rockfall was 0.00001 cubic metre of rock.

This project showed that the mean monthly rockfall activity (total volume of rock falling out of the face) is directly correlated to the size of the final failure. In addition, it can be seen that in the month before a significant failure, the total rockfall volume for that month increases significantly.

# New IMPROVEMENTS to sitemonitor: rockfall analysis

The reason for this correlation can be explained in geological terms. Rockfalls are caused by differential strain and deformation of the rock mass. This can coincide with the evolution of a brittle fracture. If a fracture starts to develop that daylight on the rock face, then the increasing stress at this point will cause rockfalls. As the fracture develops, the strain deformation at the rockfall will increase causing rockfalls. Eventually this increases exponentially, leading to larger rockfalls and subsequent failure of the rock face.



Currently, most monitoring and failure prediction in the mining industry is undertaken by radar systems which focus on the detecting small scale movements of the whole rock face. This is appropriate in some circumstances but the monitoring method should be decided by the geotechnical environment. Using rockfall as a predictor may be more appropriate in some environments and this will be a useful tool for the geotechnical engineer.

Using SiteMonitor4D with the new Rockfall Analysis feature allows you to have a clear view of the stability and changes of mass within a slope, allowing you to plot the monthly rockfall activity against time. (See slide 19 of 'SiteMonitor4D Slideshare') This advanced visibility allows you to take action before a critical situation, allowing for increased safety.

# New Liebherr T 236 Mining Truck Makes big impression at MINExpo

Liebherr has introduced their new 100-tonne mining truck, the T 236. This new mining truck demonstrates the company's continued innovation in design, paired with the evolution of Liebherr's own high quality components and class-leading technology. This combination results in increased productivity, better efficiency, enhanced reliability and improved safety, while lowering the cost per tonne.

Capitalizing on decades of proven experience in off highway truck technologies, the T 236 takes advantage of Liebherr's electric drive system innovations with the introduction of the vertically integrated Litronic Plus Generation 2 AC drive system.

This revolutionary machine provides the industry with a new benchmark in the 100-tonne class for off highway haul trucks: focusing on top performance, maximum uptime and lowest possible operating costs. All components on our truck are designed and built to perform and last in the most extreme mining conditions. As a result, Liebherr trucks run much longer between component overhauls, saving time and money.

To ensure the safety of maintenance technicians and bystanders, the T 236 is equipped with double pole battery, starter motor and hoist system isolators as standard. In addition, the Liebherr truck provides an innovative drive system inhibit, electrically interlocked to grounding devices for each plug and drive power module. Operating on a voltage level of 690 VAC and 900 VDC enables regular site technicians to carry out system maintenance. An industry first, Liebherr's Litronic Plus Isolation system ensures the safety of maintenance personnel through the elimination of hazards by design.

The revolutionary in-line electrical power train layout minimizes cable length, while the maintenance free IP 68-rated plug and-drive power modules ensure reliable operation in all-weather situations. Combined with the

extended life service intervals and minimized maintenance time offered by the ground-level service points, the T 236 ensures maximum uptime.

Liebherr is committed to designing mining trucks that operators want to drive. The ergonomic T 236 cab and the superior properties of the front wheel suspension system fulfils this commitment and promotes driver efficiency with superior comfort, safety, acceleration and handling for increased performance.

The next evolution in Electric Drive System design, Liebherr's Litronic Plus Generation 2 drive system introduces advanced Active Front End technology. Making efficient use of electrical energy during retarding events, the drive system is able to deliver controlled engine speed with almost no fuel consumption.

Vertical integration of Liebherr designed and manufactured components ensures the T 236 powertrain components achieve optimal system efficiency and performance throughout the full range of applications. The T 236's innovative variable hydraulic system lowers machine parasitics to provide maximum power, while lowering fuel consumption when power is not required.

With its high take-off torque and continuous power to ground capability, the T 236 is less sensitive to grade and payload variations, providing mining customers with class-leading productivity. The T 236 is the first diesel electric truck in class to incorporate an oil immersed braking system with four corner retarding capabilities, providing reliable braking technology. All of these integrated technologies provides maximum performance, even in the toughest operation conditions: translating directly into a cost per tonne advantage.

Designed to carry up to a 100-metric-tonne payload, when paired with the R 9100, R 9150, R 9200, or R 9250 mining excavators, the T 236 provides the most complete high performance and scalable truck-shovel match, delivering the right combination for production requirements.

The first prototypes are undergoing Liebherr's intensive field functional and performance testing with an official product launch to follow. Not yet commercially available, however pre-series T 236 units will be made available for selected markets.



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