Simulators are widely used in the mining and minerals sector, though most people are probably more familiar with the systems available for mobile equipment such as haul trucks. However, simulation tools for mineral process operator training are just as important as the consequences of major errors by inexperienced or poorly trained staff in real situations can be just as serious.

**Mineral process simulation**

Global Training and Simulation (GTS), a division of SNC-Lavalin, has designed and delivered over 100 technical training programs over the last 13 years in the fields of Mining and Metals, Hydrocarbons and Chemicals, Power and Energy systems using what it describes as “innovative, culturally adapted and technologically advanced training methods and technologies.”

One such technology is the operator training simulator (OTS), a computer model which simulates the plant process (such as sulphuric acid production) and emulates or direct connects to the plant DCS. While being able to experience the process behaviour in a safe environment is very useful, the full benefit of the OTS is through the scenarios or exercises the user must complete successfully. Examples of scenarios include recognising and responding to equipment failures, control issues, faulty transmitters, process upsets, plant start-ups and shutdowns.

GTS developed a sulphuric acid plant OTS for a zinc plant in Canada which was experiencing hazardous atmospheric emissions issues due to operator error. Due to environmental regulations, each emission episode required a costly plant shutdown and detailed investigation. GTS programmed fifteen training scenarios which depicted actual situations that had occurred in the plant history. These scenarios included faulty control transmitters, loss of dilution water and loss of the main blower.

Every operator initially had to go through every scenario to improve their diagnostic and decision-taking skills, with a yearly re-certification. Two years after taking ownership of the simulator, the client asked GTS to include additional scenarios based on new equipment and control issues recently experienced. GTS states that the project was a major success as unscheduled stoppages and atmospheric emissions due to human errors stopped completely.

CAE has recently released its CAE Terra range of mining equipment simulators

As part of a major training program development, GTS is also currently developing five operator training simulators for a very large fertiliser client. These will include all main process steps from beneficiation, sulphuric acid production, phosphoric acid production and fertiliser (granulation) production. Training scenarios will be custom-programmed based on plant history and senior operator experience.

The main objectives of these simulators is to accelerate training from 2-5 years on the job to less than an year before an operator can be certified to operate, a significant time saving to counteract an upcoming retirement wave.

Another client re-trains every employee once a year on the lockout procedure – how to shut down make equipment safe to repair and maintain. This retraining takes a full day for each 1,200 employees in a traditional classroom setting. GTS developed a lockout procedure simulator which visually replicated the steps required to complete a lockout procedure for a maintenance activity. This self-learning activity allowed every employee to practice the procedure on a computer, before being tested by an instructor. Employees can take the training when they have some downtime on one the plant training computers, without requiring a full class and instructor. Most employees go through the training in an hour or less. The implementation of the lockout simulator saved five hours per employee every year since, while reinforcing the importance of a proper lockout.

Finally, GTS has developed a complete training program for a mining operation in Madagascar. Small-scale versions of process simulators (mini simulators) were used to introduce operators to the concept of process control (control loops). These simulators familiarised the trainees to simple and complex control loops, ratio and split signal loops, alarms, interlocks and even controller tuning. In a country where process training was non-existent at the national level, these mini simulators provided valuable familiarisation and basic hands-on practice.

The ECS (Expert Control and Supervision) CEMulator offering from FLSmidth is an advanced environment for training of process operators and engineers in the cement industry. While it has not yet been adapted to mining/minerals specific operations, the company told *International Mining* that it is looking at the potential of doing so. Combining decades of process design and operational experience with an extensive theoretical insight on process dynamics and the latest software technology, CEMulator from FLS Automation is a very
realistic simulator of cement plant processes.

While a training session is running, several key options are available to the instructor. The simulation speed can be changed on-the-fly to “accelerate” the process reaction upon a control action. Various types of disturbances, such as equipment failure, measurement errors or other, process specific, frequently occurring conditions can be introduced during the session. Operation input parameters such as flow or material conditions can be changed, while the mission in the training can be pre-defined with production, quality and emission target values and the associated weight factors modified.

Contrary to most cement process simulators, ECS/CEMulator is developed on a full functional control systems platform enabling the complete set of functions and features of a modern control system environment for the users.

FLSmidth states: “Having a skilled team of operators plays a crucial role in beneficial and safe operation of industrial plants. Especially in the cement industry, with the significant high cost of investment, practical knowledge and experience of plant operation has a direct effect on production economy. Insufficient insight in process dynamics and interactions, high stress factors in real time operation conditions, and lack of adequate experience in utilising the existing control system are typical reasons for incorrect operator actions. The consequences of this may result in low production quality, production interruption, equipment damage, and in worst case risk on human safety. The increasing demand on production sustainability in recent years has resulted in requirements of which the degree of fulfilment is affected by the level of skills of plant operators and engineers.”

ECS/CEMulator is an advanced and user-friendly cement process simulator which aims at process operator training in an absolutely realistic and risk-free environment; increasing operator skills in reaching pre-defined production quantity and quality targets; operator performance evaluation; increasing operator skills for optimal utilisation of a modern control system; and enabling process engineers and designers to test their ideas before practical implementations.

Simulators can also help with process efficiency in addition to operator training. At LKAB’s new KA3/KK4 5 Mt/y processing and pelletising plant at the Kiruna iron ore mine, a simulator for ABB’s automation solution provides major capabilities for increasing operational reliability and quality in production.

“All was to train operators and test changes to control systems and processes, free of interference. It saves time and raises the quality of daily processing in the plant,” says Mats Renfors, Automation Engineer at LKAB.

“In the plant, the iron ore is milled, cleaned of phosphorus in a flotation process, supplemented with a binding agent, drained and rolled into balls. The balls are transported in a 70 m long grate furnace, followed by a 40 m long kiln furnace where the balls are dried, the iron in them oxidised and the balls sintered to the desired hardness in up to 1,250°C. The final process step is slow and careful cooling in a rotating cooler with a diameter of 28 m. This is the world’s largest sinter machine to date of the grate-kiln-cooler type.

Production in the processing and pelletising plant is controlled and monitored by operators in a common control room. The automation system is ABB’s System 800xA, including the operator environment. LKAB wanted both a functional control system as well as a simulator for the control system. “We were early to realise the advantages of simulation as a part of our work with improving processes,” says Renfors. “At the beginning of the 2000s, we had for one thing problems with dosage of binding agent in another pelletising plant, and a consultant helped us with a number of simulations of both dosage and the process. Based on the simulation results, we made changes to the mechanics and the control systems, and obtained good solutions.”
Not long after, LKAB began the construction of the new processing and pelletising plant KA3/KK4. The plant was opened in July 2008, and production started with the ABB 800xA control system. A few months later, the new simulator was in place. It uses ABB 800xA Simulator, which provides simulation functionalities for System 800xA. The control system is connected with process models built by the consulting firm Optimization. Optimization handled integration between control systems and process models, and all development was in collaboration between ABB, Optimization, LKAB and the system supplier Midroc.

Rikard Hansson, system developer for the ABB 800xA Simulator at ABB in Norway, explains that the simulator uses ABB’s control systems and operator stations but runs the control system on standard Windows servers instead of ABB’s controllers. The process models simulate the process’ equipment, instrumentation, and actuators, and supply the control system with input data as similar to the actual process as possible. “Simulation is really about solving equations. Once or a few times per second, process models compute enormous equations, and the process is recreated on the display in front of our eyes. Important parts of the process have advanced modelling with major calculations, while other parts manage with simpler modelling. We were early to realise the advantages of simulation as a part of our work with improving processes”, said Hansson.

The simulator in LKAB’s plant has been successfully used for a number of different tasks. It was most recently used to test upgrades of the control system. “We’ve conducted large reviews, for instance improved reprogramming of controllers, and we’ve been able to test them in advance in the simulator. It has worked really well, primarily because it gives us the opportunity to quality-assure the process against uncontrolled machinery or other system faults,” says Renfors.

New code for the control system has also been tested in the simulator before it is transferred to the actual control system. “Changes to the control philosophy can be tested and checked, under calm and safe conditions. Other usage areas for the simulator are tests in conjunction with planning and configuration, and test-runs prior to process changes. The tests also provide improved data for the company’s decision-making process by clarifying planned changes and their results in flow and quality. Moreover, there are opportunities for solving problems with pellet quality and other product problems through implementation of suitable quality parameters in the simulator.”

Being able to run a flow in advance on the simulator, before actual operation, can greatly improve planning. Faults are detected beforehand and it can definitely shorten the start-up period. Moreover, one can simulate programming of the control system and test parameters, such as interlocks and alarms, and entire sequences in advance.

But as with other example, probably the most extensive application area for the simulator is in the areas of education and training. Newly employed operators receive training on the simulator, and further education of experienced operators includes a more extensive training program. Relevant training scenarios are developed in the program where operators are trained in a safe environment to handle unusual events. The benefits have led to interest from LKAB to obtain more simulators.

A paper entitled “A Training Simulator for Flotation Process Operators” was presented at the 18th IFAC World Congress in September 2011 by Timo Roine and Jani Kaartinen from the Aalto University Department of Automation and Systems Technology in Finland and Pertti Lamberg from the Luleå University of Technology in Sweden. It presented what the authors said is “a novel simulation concept for operator training in the field of mineral processing.” The simulations were carried out with the dynamic process simulator HSC Sim, part of HSC Chemistry from Outotec Research. The simulator was fitted to mimic an existing copper flotation circuit as accurately as possible by using metallurgical models and then integrated into a larger simulation environment, providing the operator trainees a realistic experience of the process. The simulation environment was designed to be scalable and very flexible, allowing many different usage scenarios and thus aiding in the transfer of the tacit knowledge from operator generation to the next. Concurrent work is being done on higher level analysis, utilising the results. The paper states: “Mineral flotation is a complex separation process that typically contains several stages and multiple feedback loops (ie circulating loads). Also, the reagents that are used vary and often have opposing effects. This makes the process difficult to control, at least in an optimal manner. For these reasons, the actions of the process operators and differences in their operating behaviour play a significant role in the performance of the flotation plant. Training of the operators in mineral processing has traditionally been carried out by teaching the basics of the process to the students and then letting them follow more experienced operators at work. Due to the increase in computing power and decrease in prices of computer hardware, training simulator software is becoming an important factor in different application areas. This type of simulation software has been in use, for example, in nuclear power plants and in aviation for a long time. However, in mineral flotation,
the use of such simulators has been limited.” The authors accept that this is not due to simulation not having been utilised in the mineral industry; as there are many simulation based applications in common use, for example: JKSimMet, Dynafrag, JKSImFloat, USIM-PAC and HSC Sim 7.0, but they are typically focused on aiding in design or control of the process rather than helping in operator training. To improve the training of process operators, a training simulator environment has been created consisting of flotation process simulations performed in HSC Chemistry, process logic emulation by means of software developed in Matlab, and based on Outotec’s Proscon automation system, and Proficy/HMI Cimplicity automation software for control and visualisation. In addition, supervisory teacher software has been developed to manage the student training environments. Different scenarios can be used in the training simulator to train inexperienced operators, as well as to improve process knowledge of senior operators. The environment can also be used to collect information of the operator actions and analyse and compare the performance of different operators. The authors state: “In addition, the system and the collected data can serve as a valuable means to convey important silent knowledge to following operator generations.” Another valuable asset of the system is that it can be used to train operators even before the construction of the actual plant is completed. “

Although the HSC Chemistry simulation software can be used in a variety of different applications, in this scenario it is used as an integral part of a virtual training environment in order to get trainees acquainted with metallurgical unit processes, to provide a realistic feel and response to the changes in metallurgical parameters, and to control actions made by the trainees, and finally to provide a tool for improving strategies and scenarios for process control and development. The training simulator utilises the same simulation engine as Outotec’s Virtual Experience, but with a completely different design. Firstly, the simulation model has been fitted to match the copper flotation circuit of Inmet’s Pyhasalmi mine in Finland. Secondly, the simulation environment is designed to be flexible enough to comply with different usage scenarios, scalable in the number of concurrent simulations, and distributed so that simulation speed can be increased by running CPU intensive tasks simultaneously in several computers. Furthermore, the distributed nature of the system also allows also physical distribution, meaning that teaching can be done via the internet. The basic idea in the training system is to mimic the operational behaviour of an existing flotation circuit as closely as possible and then use the generated model with copies of the existing displays being used in the plant. This makes it possible for the operator trainees to get a very realistic experience with the simulated process. Another usage scenario is to run the simulation model in parallel with the actual process and use it to give foreknowledge of – say – the implications of a given control action.

Mobile equipment simulators

Atlas Copco has been expanding its Master Driller Program in the US after proven success in other countries. The program aims to get operators to perform their best whether a mine is working with new staff, changing its fleet or just trying to increase efficiency. It involves classroom time as well as simulated drilling in a simulator cab of an actual drill rig. Wesley Stivers is the regional training manager of North and South America for Atlas Copco Mining and Rock Excavation Service Division (MRS). He comments, “We are starting the program for the Pit Viper and will expand the Master Driller Program across other product lines in the near future.” Training will first be offered through the Garland, Texas, Atlas Copco MRS hub. Stivers and Versie Wallace, US training manager for MRS, are also working on plans to set up training in other Atlas Copco stores across the country and may expand the program to private distributors later. Wallace said, “It’s very exciting training that will ensure that our operators are skilled on the specific machines they operate.”

At one mine currently going through a mine expansion, prior to the operation receiving shipments of their new Atlas Copco Pit Viper 271 blasthole drill rigs, operators began a Master Driller training program, enabling them to drill on the first day that a real PV271 arrived. Despite many years of experience, the Superintendent and drillers completed the training to help them communicate better, as well as improve jobsite collaboration, and improve overall efficiency. The trainees were a mix of ages, talents and backgrounds. One was an experienced 58-year-old who has been drilling for 28 years and purchased his first computer only three weeks earlier. One was 47 and had drilled for years with some computer experience. A third was 28 with eight years of drilling experience and many years of computer gaming. During the three-day course, the group studied drill start-up and stop, safety procedures, tower-up, propelling, advanced propelling, drilling and advanced drilling.

As one Master Driller student simulated the drilling of five holes, his skill level increased, completing the last two holes in half the time it took to do the first one. This section had an overall time limit of one hour. On the first attempt, he failed it by two minutes. Repeating the level, he finished it in just 32 minutes. By the second run, each operator had cut his time in half and had become proficient with the controls.

Almost all Atlas Copco blasthole rigs, along with underground and surface crawler drill rigs, have training programs designed to help operators become Master Drillers. Training on equipment other than the Pit Viper will be available soon in the US. Master Driller training can result in higher productivity; reduced costs from damaged equipment, increased safety, as well as providing documentation of workforce skills.

What Atlas Copco believes sets the Master Driller Program apart from others is its incorporation of simulated tramming and drilling in an actual cab, which gives participants a safe learning experience while eliminating the risk of damaging equipment or injuring themselves. The Master Driller Program consists of theoretical and manual training available through all Atlas Copco customer centres, who can rent the simulators if they don’t yet have them. The program is suited for novice and
experienced operators who progress through Bronze, Silver and Gold levels of training, which each take just a few days.

Bronze level involves learning in the classroom or e-learning at home and covers topics such as rock types, technique and theory of drilling. In Silver level simulator training, trainees learn by using a rig and by working with a hands-on simulator. The simulator features large LED monitors mounted in the window spaces of the rig’s cab so the environment appears real. The cab moves in response to the actions of the operator using real controls. In the case of training on blasthole drill rigs, the simulator even gives prompts as the rig enters unstable ground. Just as in an actual rig on the job, if the operator attempts to auto-level the drill before a safe position is reached, the drill will not allow the procedure. The operator must successfully stabilise the rig before levelling can resume.

Gold level is on-the-job training, where an Atlas Copco product specialist works with trainees one-on-one on their job site. Previous training is reviewed on an actual rig and is repeated if necessary. Only after the Gold level is passed is an operator called a Master Driller. For an Atlas Copco Boomer E2C for example, the combined training scenarios include: position feeders; basic drilling; basic tramming; setup and positioning; navigation with different methods; advanced drilling; advanced tramming; and calibration.

Robert Dikmen is a Training Manager at the Mining and Rock Excavation Service Division and is responsible for the Master Driller Program. He said, “The feedback we’ve received from our customers is that the operators’ understanding increased and translated directly into greater production and greater safety.” The Master Driller Program with simulated drilling in a simulator cab of an actual drill rig has been offered for two years. With the success the program has shown, Dikmen said Atlas Copco is now extending the simulator fleet and developing a program for more products to complete the Master Driller offering. Simulators are currently available for the Boomer E2C, SmartRig D7C, SmartRig D9C, SmartRig F9C, FlexiRoc D50-D65, SmartRoc D65, Pit Viper 271 and Simba E7C.

In May 2012, Suncor Energy awarded its training department and VISTA Training one of eight President's Operational Excellence Awards for the implementation of the innovative TruckLogic haul truck operator training curriculum at its oil sands mine in northern Alberta. TruckLogic is an integrated haul truck operator training program, developed by VISTA with significant input from Suncor that includes computer-based training modules, simulation and on-the-job training materials in a blended learning platform. The mine implemented TruckLogic as a pilot program in April 2010 at its oil sands mine, where it resulted in a 50% drop in incidents and a 4.5% increase in productivity. These improvements have continued to hold over a year later, and according to VISTA, TruckLogic is now used to train all the mine's new equipment operators.

The simulator part of TruckLogic is Simlog's Mining Truck Personal Simulator, which puts operators at the controls of a large haul truck at work in a virtual mine, in interaction with an electric rope shovel. The Instructional Design consists of a series of Simulation Modules of increasing difficulty, with automatic measures of how quickly, and how carefully, the simulated work is performed. TruckLogic calls upon three key modules, for Driving, Dumping, and Loading, and then evaluates the simulation results according to best practices. The Mining Truck Personal Simulator can also be used "stand-alone", when the simulation results indicate that the operator needs training help. Simlog has also this year announced the availability of a Simlog branded Operator Chair, which it states was developed in response to demand from customers for a chair-based simulation experience that leverages the versatility of Simlog’s Multi-purpose Replica Controls - widely used with Simlog’s unique table-top mounting option. Key features include an authentic industrial operator seat with air suspension and moveable headrest. It is fully adjustable in positioning (forwards/backwards, up/down) and the armrests can be configured to various heights and angles. The Operator Chair is also configured with consoles for the left and right hands which house USB-ready replica levers and joysticks that can be used with many Simlog Simulators and fully support the equipment functionality of the respective simulation software. An industrial steering wheel, pedals and other options are also available, depending upon the Personal Simulator requirements.

The Operator Chair is available in two primary platforms. Each platform offers a variety of possible configurations with joysticks, levers, and pedals. A Dual Console Platform consisting of multi-purpose replica joysticks can be used for Simlog’s hydraulic excavator, wheel loader, mobile crane, tower crane, harvester and forwarder personal simulators. A steering wheel platform with full steering column can be used for Simlog’s Mining Truck, Off-Highway Truck, and Wheel Loader Personal Simulators. The chair is designed to facilitate multi-purpose use whereby a single Operator Chair can be used for multiple Personal Simulators. This feature, unique to Simlog, offers a cost-efficient alternative to multiple dedicated sets of simulator controls according to the company.

VISTA Training has also launched new crawler dozer and ADT training modules as part of its growing “Silver Series” of web-deliverable operator training programs, which are focused on helping operators to work proficiently and safely in all types of ground conditions. Both programs are web-based, meaning trainees can view them at any time where a high-speed internet connection is available. They are aimed at providing trainees with a solid foundation of equipment and safety knowledge before they begin classroom or field training.

The content of the crawler dozer course, entitled Dozer – Basic Operation & Safety – is focused on three key areas. In the Components lesson, trainees learn the major blade and track components of the track dozer and how they contribute to pushing material; Controls covers the controls of the machine and their function. This lesson also describes typical working conditions and basic operating techniques of the modern dozer. Finally, Design and Application focuses on using a dozer productively through effective project management – how to approach push and return cycles for maximum efficiency and productivity including analysis of ground conditions and how they affect productivity, as well as the different types of dozer operating modes, including cutting, ripping and carrying material. Xstrata Coal’s best-practice dust management employed at open pit coal mines in the Hunter Valley region of New South Wales has now been extended to equipment operator training thanks to state-of-the-art training simulators from Immersive Technologies. Xstrata Coal NSW Training Manager, Darryl Cooper, said: “The idea of employing our advanced equipment operator training simulators to educate staff on actions
that can reduce dust emissions to acceptable levels was explored and then implemented, with excellent results so far. Working with simulator supplier Immersive Technologies, we have adopted industry leading practices for integrating simulation technology into our group operations training program. We have made a significant investment in a fleet of PRO3 simulators and a dedicated, skilled team of trainers and coordinators to deliver sustainable results. This has been achieved in the second year of implementation, and is now being leveraged with quality feedback and collaboration with our supplier of simulation technology, leading to these new development initiatives. Our ongoing commitment to environmental management and workforce safety compliance is evident in our annual operator competency assessment of all mobile equipment operators. They must achieve full compliance, which includes an emergency response assessment check.

Immersive Technologies worked closely with Xstrata Coal NSW on the development of new features for the latest version of SimControl, the software at the heart of the PRO3 Advanced Equipment Simulator. The enhancements resulting from this collaboration specifically target dust level monitoring and control.

In targeted scenarios in the simulation training program, an equipment operator observes dust levels from ‘drone trucks’ in front of the operator’s machine, and must take appropriate action. The actions taken by the operator are automatically monitored and assessed, with real-time feedback and debriefing or reporting after the training.

Another scenario simulates excavator dust generation during dumping. Operators are given instruction and then assessed on their technique in maintaining the correct dumping height to produce the least amount of dust from the truck tray being loaded. The higher the operator rolls out the bucket, the more dust is generated.

Immersive Technologies Regional Business Development Manager, Phillip McBride, said, "Improvements developed in consultation with Xstrata Coal have now been released in SimControl 4.4, which is a software upgrade distributed to Immersive Technologies customers under service agreements. This new functionality quantifies equipment operator risk associated with negative environmental behaviours and facilitates rectification of the negative behaviours."

Immersive has also announced a strategic alliance with ICOM Productions, which will combine Immersive’s Advanced Equipment Simulators and Professional Services, along with ICOM Productions’ tailored eLearning and Instructor Led Training development services. Immersive states that it can now offer a complete “Blended Learning Solution” and deliver “unparalleled training effectiveness and efficiencies, allowing for the dissemination of best practice training packages, with the organisational capabilities to ensure every solution is perfectly tailored to the customer’s specific workforce development challenges.”

The company highlights that the shortage of machine operators within the mining industry has another unaddressed root cause in a lack of skilled trainers, which presents arguably the most significant bottleneck to the output of machine operators for the mining industry. Further, common training practices reduce organisational capacity to engage trainers in higher value activities such as coaching, feedback and simulation centric continuous improvement and other strategic workforce initiatives.

Immersive hopes that by utilising ICOM Production’s eLearning and Instructor Led Training, in conjunction with its Advanced Equipment Simulators, organisations can increase the ratio of machine operators to skilled trainers, freeing skilled trainers for activities where they add most value.

ICOM Productions has an established suite of eLearning content for mining equipment including haul trucks, excavators, dozers, and graders, along with courses covering the entire mining process, with topics including human resources, plant operation and maintenance.

The latest news from Immersive, announced at MINExpo, is that it has launched the industry’s “most advanced, complete and scalable solution for mining equipment operator development.” CEO and co-founder, Peter Saltfinger said, “This launch will accelerate pursuit of our mission to make every mining and earth moving equipment operator in the world safer and their employer more profitable, while positioning Immersive Technologies for its next phase of growth.”

The Advanced Equipment Simulators offering will be taken to a new level with the launch of a complete Blended Learning Solution, new tools and technologies, and an extended range of professional services. The new tools and technologies launched at MINExpo include SimCloud, which allows mining operations to maintain complete visibility over local or global Simulation training programs via a secure website; Global Operator Benchmarking, which allows mining operations to benchmark their equipment operators against global norms; the Trainer Productivity Station (TPS), which is designed to alleviate the industry shortage of experienced trainers; SimDesktop, which takes the powerful simulator data analysis and scenario configuration tools and makes them more accessible; and SimMentor, which facilitates briefing before and debriefing after simulation training sessions, increasing training effectiveness and freeing up simulator time.

Professional services on offer now include TrainerAdvantage, to ensure training staff readiness; Training Systems Integration, which delivers best practice program implementation; and Continuous Improvement Projects, to quickly deliver quantified mining operational improvement and program management support.

CAE recently released its CAE Terra range of mining equipment simulators. The company says that its experience of developing the highest fidelity devices in civil aviation and military mission training has been applied to CAE’s mining equipment simulators. CAE comments: “To the end user this results in a highly realistic training experience with a vast reduction in the incidence of motion sickness. As a business that trains over 100,000 equipment operators and maintainers annually, CAE has applied its expertise in training systems to develop a similar offering for mining. Delivering a high fidelity simulator within a complete learning system is the solution to lift simulator utilisation rates from less than the 3% currently experienced in mining to more than 85% as routinely achieved in aviation. This utilisation holds the key to efficient and effective training. In military, simulation training is one sixth the cost of using real equipment, and riskier scenarios can be practised safely. In civil aviation, 24/7 simulator training centres are the norm, and existing pilots have a mandatory requirement for continuous training to ensure they remain highly productive and ready to respond to emergencies as second nature.”

Beyond training efficiency and safety, CAE Mining has incorporated best practice metrics into its simulator training scenarios. Modest gains of 3-4% in loading times can translate into significant annual savings. This focus on productivity improvement allows for ongoing training of experienced operators, moving the simulator from a familiarisation tool for new operators to a self-contained continuous improvement system.

Peoria-based SimInformation LLC has announced the release of two new Cat Simulator Systems for mining. The Large Track Type Tractor and Mining Truck systems are set in an open pit mining environment. Authentic controls combined with simulated exercises aim to deliver a realistic training experience for operators. The Large Track Type Tractor system teaches control familiarisation, machine walkthrough, trimming, ripping, slot dozing, dozing over a highwall and slope maintenance. The Mining Truck system, teaches control...
familiarisation, machine walkaround, mine site
driving, braking, mine site hauling, loading with
a rope shovel, unloading at a crusher and a
highwall, and full production cycle. Both
simulator systems also include two Open
Training modes. Exclusive reporting features
mean all simulator sessions are measured,
reported and recorded so instructors and users
can track progress. Simformation argues that
both PC-based simulator systems offer the most
engaging and cost-effective experience available
virtual training.

President Ken Pflederer states: “Mining is a
booming business all over the world. It’s a
dangerous business and there is a serious need
for training. Cat Simulators deliver a realistic
training experience for dozer and truck
operators to learn proper procedures without
harm to other personnel or machines. Using
simulators as part of an end-to-end training
program can provide immediate cost savings to
a mine’s bottom line by reducing fuel costs,
machine wear-and-tear and training multiple
operators on multiple machines at one time.”

Special features on the Cat Simulator
Systems such as multiple languages (Spanish,
French, Chinese and Portuguese); and
companion tablet eBook training. In addition to
the new mining simulator systems, Cat
Simulators are available in models for heavy
construction dozer, hydraulic excavator, off-
highway truck, M-series motor grader, small and
large wheel loaders and wheel tractor-scraper
training.

ThoroughTec states that it is able to develop
new cabs faster than anyone else, a legacy of its
military engineering background and having
“the largest development pipeline in the
industry.” While ThoroughTec is constantly
adding new models to its range, already among
the broadest in the mining simulator industry, it
says it is also constantly looking to diversify its
product offering into new training segments. A
devlopment has been the extension of the
range of training products to meet the full
spectrum of customer needs. The CYBERMINE
training system now includes a Computer Based
Training (CBT) system and an Operator
Familiarisation Trainer (OFT), both developed to
complement the proven, highly regarded Full-
Mission Simulator (FMS) and provide a turnkey
training solution that optimises training
outcomes and returns on investment.

“We’ve partnered with local industry
expertise in adult education specialists, bringing
our knowledge of mining training and making
sure that our CBT package seamlessly integrates
with the OFT and FMS, so there’s no disparity
between them and it’s a seamless progression
through the training infrastructure,” said
ThoroughTec Executive Director Dr John
Waltham. The CYBERMINE CBT will be used to
train operators the theory needed to
operate a particular piece of equipment. The
system makes use of photographic still shots,
2D and 3D computer animations, and site video
overlayed with audio to walk the trainee through
the controls and operation of the equipment,
and also introduce the trainee to the

The CYBERMINE simulator platform is now in
its fourth generation, benefitting from over 20
years in land-based simulation experience.
Proven cabs that remain popular are the Sandvik
DD420 and Atlas Copco Rocket Boomer 282 drill
rigs, while new underground cabs include the
Sandvik TH230 ADT and LH209 LHD, and the
Normet Spraymec 1050 shotcrete sprayer.
Recent additions to the surface range include a

**CYBERMINE training options from ThoroughTec**
**CYBERMINE4 underground mining simulator officially opened, and features a state-of-the-art training facility.**

The University of Alaska, Valer-Vale and Curtin University’s Western Australian School of Mining, having chosen ThoroughTec as their flagship simulator provider. The University is regarded as the most accurate replication of a drag line available.

ThoroughTec says it has gained significant ground in the Asia Pacific region too, including sales to Rio Tinto's Northparkes and Argyle mines, Ngarda, and Wesfarmers Curragh, all in Australia, as well as Freeport's Grasberg in Indonesia. Africa remains a ThoroughTec stronghold, with a particularly strong presence in South Africa, while a number of mining training institutions across the world, including the University of Alaska, Valer-Vale and Curtin University's Western Australian School of Mining, have chosen ThoroughTec as their simulator provider. The Rio Tinto Block Cave Knowledge Centre of Excellence at the Northparkes mine has been officially opened, and features a state-of-the-art CYBERMINE® underground mining simulator. The A$13 million centre is the world's first such centre dedicated to block cave mining and will play an important role in the “sharing and development of knowledge around safety, productivity, technical expertise and technology in the Rio Tinto group worldwide.”

“ThoroughTec strives to build the most reliable, realistic mining simulators on the market, so every time an underground training institution of this calibre chooses us over our competitors is a confirmation that we are at the top of our game.”

The simulator offers an efficient and cost effective way of developing the required specialised operator skills, for both new recruits and experienced operators converting to block-cave mining. The 360° high-fidelity display totally immerses the trainee in the mining environment, while the simulation software accurately models the behavioural characteristics of the equipment being simulated. External interactions with the environment, such as a drill-rock face interactions or tyre-terrain interactions, are all mathematically modelled for accurate, authentic feedback.

A purpose-built simulation facility makes up an integral part of the 1,200 m² Northparkes training centre. Because this is a classroom environment, Northparkes opted for the CYBERMINE® Fixed Facility Unit, as opposed to the containerised systems that are more commonly used on mine sites for their durability, extreme weather proofing and transportability. The Fixed Facility Unit features the same training capabilities as the containerised system, including the unique ability to host both underground and surface cabs on the same base with only the addition of an adaptor plate, but is more suitable for a classroom environment for group training. For the first phase of the project, a Sandvik LH514E loader cab was paired with the base unit. To ensure authenticity and accuracy in training, Northparkes also purchased an own mine world. This entails an exhaustively researched and ultra-realistic visual recreation of the Northparkes mine site, allowing their operators to train in the same environment that they work in.

The Northparkes centre will be used to train miners and engineers from Rio Tinto mines around the world, developing the technical and operational skills needed to create and operate block cave mines. Among the first trainees will be teams from Oyu Tolgoi mine in Mongolia and Argyle diamond mine in Western Australia, both mines that are already successfully running their own CYBERMINE® training programmes in conventional mining operations.

Organised events can also provide a focus for mobile equipment training. Eurotire, the leading supplier of earthmover tyres for the mining industry recently announced the launch of EuroDrive – an educational and team building training event held internationally for miners.

The event is described as “a competitively spirited program” that focuses on driver training for large mining equipment, and specifically the factors affecting the life of a tyre. “An extension of the Eurotire customer service philosophy, EuroDrive was established to ensure correct training is conducted for drivers at mine sites around the world to achieve the full potential of their tyres,” said Helen Ratnikova, Coordinator of the Eurotire Training Centre. “However, it’s more than that. We deliver the program in an entertaining way. The drivers establish teams to compete in obstacle courses to sharpen their driving skills and train on spillage avoidance, as well as create unity at the job site. In the process, they build knowledge in tyre life management.” The EuroDrive program was initially introduced in Kazakhstan and Ukraine, and has events scheduled for mines in Russia and India by year’s end. The judges and scorekeepers at these events are certified Eurotire personnel.

Regulating training and qualifications is also an important aspect of the industry but does not necessarily stand still. As of September 2012, the Mineral Products Qualifications Council (MPQC) has become the Standards Setting Organisation (SSO) for the Extractives and Mineral Products sector in the UK. MPQC will represent its industries’ interests to government and other key agencies in all matters related to education, training and qualifications. MPQC is supported by all the main sector trade associations in becoming a formal SSO which marks an important step in ensuring the continuing development of, and access to, high quality sector specific education, training and qualifications. MPQC stated that it and the mining industry will work together to “forecast skills needs of the industry and to develop skills solutions which are fit-for-purpose.”

MPQC has a proven track record and a vast amount of previous experience in these areas having been previously a recognised National Training Organisation. MPQC believes that it is well placed to drive forward the standards necessary to meet the industries’ target of ensuring a fully competent workforce at all levels, which will lead to the achievement of real business benefits.

As an SSO, MPQC will also provide on-going access to National Occupational Standards; careers information; apprenticeships; guidance on workforce development and any opportunities for accessing funding. It will also be the single source representing the views and ambitions of the sector to government and its various agencies. IM