Innovations in Mining Operator Efficiency Through Simulation Based Training Technologies and Processes

By IMMERSIVE TECHNOLOGIES [1]

Within the often-hazardous mining industry, simulation training has quickly gained recognition as a significant method of increasing site safety and profitability through improved operator skill and knowledge. Simulators provide operators a safe environment to learn and practice their skills; Immersive Technologies' simulators allow the operator to practice for a range of possible emergency situations. Many of these situations are too dangerous, too difficult or too expensive to test in an actual mine.
Immersive Technologies has deployed over 80% of the Advanced Equipment Simulators operating around the world to the broadest range of mining environments. This experience, together with ongoing feedback from customer base and Original Equipment Manufacturer alliance partners, has provided Immersive Technologies with the knowledge necessary to develop the most accurate, reliable and outcome oriented Equipment Simulators.
Immersive Technologies' Equipment Simulators are supported by the industry's most comprehensive range of compatible tools, technologies and professional services. This ensures a solution to meet or exceed your needs can be defined, delivered, implemented and generating operational results quickly and with very low risk.

Using Simulators to Train Mining Operators

Simulation based operator training has been successfully applied to a range of diverse industries where high risk and high costs are everyday issues requiring smart solutions. Whether piloting a plane or launching a space shuttle, simulation training has been proven to dramatically reduce risk, cost, unscheduled maintenance, increase trainer effectiveness and efficiency while maximizing productivity.

Within the often-hazardous mining industry, simulation training has quickly gained recognition as a significant method of increasing site safety and profitability through improved operator skill and knowledge.

Simulators provide operators a safe environment to learn and practice their skills. Immersive Technologies' simulators allow the operator to practice for a range of possible emergency situations. Many of these situations are too dangerous, too difficult or too expensive to test in an actual mine.

Operators can also be shown and assessed for the proper operating technique much more quickly and accurately than the traditional in machine approach. Focus on improving operator technique with Immersive Technologies' simulators has delivered proven results including longer tire life, reduced spot time, reduced brake abuse, improvements in fuel use, reduction in engine overspeeds and more.

Simulator training allows operators to be shown and assessed without the need to borrow machines from production. This allows new operators to practice many skills before being placed into a production circuit. Because operators are consistently shown and assessed on the proper

(1) The article provides a company perspective on the topic addressed, it was written and provided by the Marketing Promotions Department. For more information and associated media please contact Andres Arevalo, Global Marketing Promotions Manager, Immersive Technologies, aarevalo@immersivetechnologies.com, Tel: +61 (8) 9347 9011, Fax: +61 (8) 9347 9090.

Photo 1: The PRO4 from Immersive Technologies is built specifically for surface mining. With a 3x Full HD frontal display plus a large integrated rear display, the PRO4 is the most advanced simulator platform on the market. It delivers realism at a level not previously seen by the mining industry. The PRO4 provides a robust, high fidelity platform for driving operator optimization and business improvement.

operator techniques they have a better understanding and knowledge of the real machine.

Simulation Training Impact on Safety

The ability to train operators to react correctly during potentially life-threatening situations is invaluable in mining. Many dangerous situations rarely take place, so training operators to understand proper protocol in a safe environment is essential for mining operations to be assured their operators are better prepared and can react appropriately with confidence.

Operators can be trained on how to respond to machinery emergencies such as engine fires and brake failure as well as the correct responses to emergencies occurring elsewhere on the mine site.

With over 100,000 operator training sessions analyzed we know that less than 50% of experienced operators can recall the procedure to respond to an emergency machine failure. Immersive Technologies has proven to deliver over 90% pass rates using their simulation training solutions. Below are two examples of reported safety training improvements.

Photo 2: The IM360 from Immersive Technologies is built specifically for underground mining with the flexibility to train on surface mining environments. It delivers cutting edge technologies in a lower cost high fidelity platform.

REF#SF0210:
Surface Coal Producer, USA

During an actual truck fire incident employee had an engine fire and correctly handled the event. In the incident review the employee said they'd recently completed simulation training and felt completely comfortable handling the fire event.

REF#SF0410
Underground Mining Services Provider, Australia

Underground truck operator had truck catch fire; the operator attributed recent simulator training to the correct actions taken during the emergency, keeping the operator safe and saving the company millions of dollars in a potential full machine loss.

Simulation Training Impact on Unscheduled Maintenance

The mining industry continues to demand safer, more productive and less costly equipment operators to achieve sustainable mining operations. One-time improvement initiatives have already hit the financial bottom line and their impact is lessening. Now operations are looking for sustainable long-term, solutions that integrate operational data, analytical tools and decision making leveraged to improve financial outcomes on an ongoing basis.

Machine availability is an ongoing challenge in the mining industry. Poor operator behaviors and operational practices such as abusive shifting, engine overspeed and brake abuse contribute to a loss in production while machines are down. Reactive maintenance is an inefficient way to address fleet availability and companies are more likely to suffer from heightened maintenance costs, longer periods of unplanned equipment downtime and lost mine productivity. Properly trained operators can directly reduce unscheduled maintenance costs and increase site productivity. Targeted simulation training from Immersive Technologies delivers, in the field, an average of 62.2% reduction in brake abuse, 69.8% reduction in abusive shifting and 54.5% reduction in engine overspeed.

Photo 3: The LX6 from Immersive Technologies is a medium fidelity simulator platform perfect for machine and site familiarization, emergency response and compliance training.
This platform offers six full HD screens for a large field of view, a smaller footprint compared to high fidelity simulators and ample wide horizontal view for truck, shovel and excavator training programs. The large wide vertical view offers clear visibility when digging, dozing or grading. The LX6 is compatible with all surface mining machines simulated by Immersive Technologies and shares the underlying technology of the industry leading PRO4 and IM360.

REF#UM0313
Surface Mining Operation, Indonesia

Exponentially increasing cost of fuel usage, engine overhaul (from engine overuns) and brake replacements (overheating/wear). Cross functional training programs consisting of measuring operator baselines, coaching, evaluation followed by monitoring in pit operation and retention assessments in their Advanced Equipment Simulator resulted in 90% reduction in VHMS cooling brake oil overheat frequency.

REF# UM0112
Coal Operations, USA

Production cost per ton steadily increasing as the development of the site matured. An Advanced Equipment Simulator was installed and utilized for approximately 12 hours per day, 5 days a week. Remaining training time is spent out in the field or in the classroom resulting in reduction in abusive shifts, high brake temperatures and machine up-shifts.

Simulation Training Impact on Productivity

Equipment performance is heavily dependent on operator skill, knowledge and attitude. The Immersive Technologies approach ensures customers focus on the right issues that will deliver the highest returns.

Every mining operation and training center has different needs and priorities that require customization, flexibility and consultation to maximize outcomes. Solutions from Immersive Technologies can include trainers, consultants, supervision and technology including flexible hire of Simulators.

REF#PR0511
Energy Coal Producer, South Africa

Customer was under pressure to show marked improvement in their overall production across all of their mine sites with an identified risk regarding the absence of a formal Dragline operator training strategy. A comparison of operator performance in the six months before and six months after the training showed:

- 4% improvement in cycle times
- 10% improvement in swing times
- 5.7% improvement in bucket fill factors

REF#UM0913
Crude Oil Producer, Canada

An initial training needs analysis demonstrated an opportunity to improve haul truck spot times. Data analysis re-

vealed that only 20% of the workforce were responsible for the majority of lower than expected productivity. Upon the completion of the training initiative average spot times were reduced by 9 seconds.

REF#PR0613
Iron Ore Producer, USA

Simulator data was used to track progress of production specific skill and knowledge retention at three sites. Infield data was collected and analyzed both before and after training. The end result was an average of 24.3% improvement in spot times across all three sites.

Simulation Training Impact on Fuel

Within the mining industry it is becoming increasingly important to focus on fuel preservation to control the cost of production as well as to meet increasingly stringent environmental requirements. The training solutions from Immersive Technologies are designed to give equipment operators the skills and knowledge they need to operate in a productive manner while assessing and eliminating behaviors that cause excess fuel consumption.

The simulator technology includes detailed monitoring of operator behaviors which directly relate to excess fuel consumption including levels of throttle and brake application for specific situations. This has resulted in an enhanced assessment tool for managers to determine which fuel inefficient operator behaviors are most prevalent on their site and represent the greatest opportunities for savings.

REF#CS0213
Surface Mining Operations, Indonesia

Site was over budget on monthly fuel consumption costing the site an additional $100,000 USD per year. After simulation training fuel consumption over a four month period was reduced by 6.9% below the site budget, saving the site an estimated $500,0000 USD annually.

REF#TR0411
Mining Services Provider, Australia

The company set an initiative to address rising fuel costs & greenhouse gas emissions using Advanced Equipment Simulators and Training Systems Integration from Immersive Technologies. Historical fuel consumption rates were benchmarked and operators were randomly assigned to either a training or control group. The training group received simulator based sessions targeting several common operating errors including aggressive throttle application, aggressive braking and speed control. The control group received no instruction. A comparison between pre-training and post-training fuel consumption demonstrated a 6.3% greater improvement in fuel consumed per kilometer in the training group than the control group.

Simulation Training Impacts on Tires

Tires represent a key maintenance cost of modern haul trucks and a powerful area for cost containment. Poor operator practices lead to premature tire replacements.

Photo 4: Immersive Technologies works closely with mining operations and equipment manufacturers to solve real mining industry problems in areas of safety, productivity, reactive maintenance and the availability of skilled equipment operators. This approach has allowed Immersive Technologies to consistently deploy solutions that deliver Real Results, while accumulating an extensive catalogue of quantified business improvements achieved by our global mining customers.

This particularly affects mining operations in times of high demand and tire scarcity. Properly trained operators extend tire life without impacting productivity. Immersive Technologies delivers an average of 10.4% increased tire life through their Advanced Equipment Simulator training. This training gives equipment operators the skills and knowledge they need to operate in a productive manner while assessing and eliminating behaviors that cause unnecessary tire wear.

The simulator technology includes detailed monitoring of operator behaviors which directly impact tire wear including operation around spillage, dry steering, aggressive cornering and usage of service brakes at excessive speeds. This has resulted in an enhanced assessment tool for managers to determine which tire wear operator behaviors are most prevalent on their site and represent the greatest opportunities for cost reduction.

REF#UM00913
Crude Oil Producer, Canada

A Continuous Improvement Project was initiated utilizing an Advanced Equipment Simulator as the agent to change employee behavior in the field.

Operators with the lowest performance scores were trained to avoid obstacles reducing tread impacts and sidewall cuts.

The same groups of operators were trained to reduce dry steering to reduce tread and bead separation.

Resulting in 33% Decrease in Tire Replacements.

Photo 5: WorksiteVR Quest from Immersive Technologies a tool designed for the mining industry that allows users to virtually experience and engage safely in worksite environments. It assists its users in understanding safety hazards, procedures and emergency situations in order to make mines safer and more profitable.

Market Leading Virtual Reality Training for Mining

As the market leader in next generation training technologies Immersive Technologies is leading the way in virtual reality development with WorksiteVR™ Quest which allows users to virtually experience, engage and understand surface and underground environments, safety hazards and emergency situations.

WSVRQ is the safest possible environment to conduct mine training activities, using scenarios that make it easy to train, benchmark and assess operators within an office or training facility. The trainee undergoes short, high-impact learning experiences which lead to high levels of learning retention.

Conclusion

Immersive Technologies has deployed over 80% of the Advanced Equipment Simulators operating around the world to the broadest range of mining environments. This experience, together with ongoing feedback from customer base and Original Equipment Manufacturer alliance partners, has provided Immersive Technologies with the knowledge necessary to develop the most accurate, reliable and outcome oriented Equipment Simulators.

Immersive Technologies' Equipment Simulators are supported by the industry's most comprehensive range of compatible tools, technologies and professional services. This ensures a solution to meet or exceed your needs can be defined, delivered, implemented and generating operational results quickly and with very low risk.

Immersive Technologies solutions harness the power of data to improve safety and profitability in mining operations. Detailed information is captured allowing for in-depth assessment of equipment operator strengths and weaknesses.