

THOROUGHTEC<sup>™</sup>  
simulation



CYBERMINE<sup>™</sup>  
simulator system 

SOFT ROCK MINING SIMULATORS

**“ Our safety and productivity has been significantly enhanced through the simulation of our entire soft rock fleet.”**

The CYBERMINE range of soft rock simulators use highly advanced simulator technology and training techniques to effectively train operators of soft rock mining equipment such as continuous miners, shuttle cars, bolters, ploughs and shearers. These vehicles, the operating procedures and the mine world are highly configurable to your specific needs. With a CYBERMINE soft rock simulator, your operators will develop their skills and experience, so that your mine site operates at optimum productivity levels.

#### *Accurate replications*

All simulated vehicle behavioural dynamics are based on detailed mathematical models that use OEM specifications to provide accurate behavioural realism. ThoroughTec's high-fidelity simulators are true to the

original vehicle in every way, from appearance of the cab to authentic replication of the operator interfaces. They operate in a high-fidelity 3D mine world featuring general and operational areas, optimised for maximum performance and training value. The simulated equipment interacts with Artificially Intelligent (AI) miners and other AI equipment.

CYBERMINE soft rock simulators are extremely accurate replications of the original vehicle and may include customised procedural and operational features specific to your mine site. Any continuous miner, shuttle car, bolter, plough or shearer from any OEM can be simulated, along with OEM specified options.



#### *> Physically accurate vehicle cab*

The trainee operator executes all tasks from a highly accurate replica of the vehicle hardware, whether remotely operated or from a physical cab interior. For remotely operated vehicles, the operator controls the vehicle with a hand-held remote accompanied by its testing and charging unit, where applicable. Cabs feature fully functional controls including steering wheel, switches, gauges, levers, pedals and joysticks as required.



## **A SIMULATED VEHICLE THAT LOOKS AND FEELS REAL**

#### *Highly realistic equipment*

Continuous miners have been developed to meet the high productivity requirements of today's underground mines. CYBERMINE continuous miner simulators accurately simulate propelling, sumping, shearing, brow- and under-cutting, trimming and loading of the AI shuttle car. Operating a CYBERMINE continuous miner is like operating the real vehicle, but without the high costs and inherent risks.

The shuttle car is a vital link in the production cycle, ensuring that cut material is loaded and transported from the continuous miner to the feeder breaker. The accurate positioning and timely operation of each shuttle car ensures continuity in the cutting phases of the continuous miner, resulting in higher ore extraction rates.

Operating a bolter underground is not only a risky operation for the operator, but can result in a potentially dangerous environment for the follow-up crews that need to work under the secured material. Inexperience in this role can pose a serious risk. CYBERMINE bolter simulators combine highly advanced simulator technology and sophisticated training techniques to train bolter operators in a virtual world where mistakes don't endanger lives or affect productivity. Features such as mesh handling, mechanical or manual loading and various bolt anchoring methods can be simulated, each tailored to customer-specific requirements.

Proficient operators are essential to optimise productivity at these stages of extraction and CYBERMINE training simulators are unequalled in their ability to achieve this.

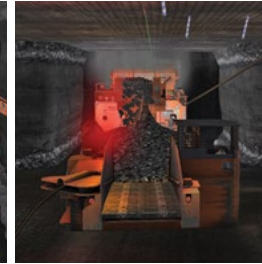


> **Advanced terrain and systems modelling**

ThoroughTec Simulation uses advanced terrain and ore body modelling to complement the simulated equipment. Operators are required to know how to respond to varying rock conditions to maintain productivity levels and make safety conscious decisions at all times.

> **Advanced vehicle behaviour modelling**

All simulated equipment dynamics are based on detailed mathematical models that use manufacturer specifications to provide realistic behavioural responses of the machine to operator inputs and mine world / ore body interactions. All actions feature realistic audio-visual and tactile feedback for complete immersion in the training scenario.



> **Multiple configurable scenarios (vehicle dependent)**

The virtual world includes a number of scenarios, each set in an appropriate area for the objective, including:

- Sumping and shearing
- Brow and under-cutting
- Propulsion / tramming
- Loading and dumping
- Trimming
- Main face and box cuts
- Bolting (level and decline)
- Bolting (cross-cut face)
- Bolting (even and uneven face)

> **Variable world settings**

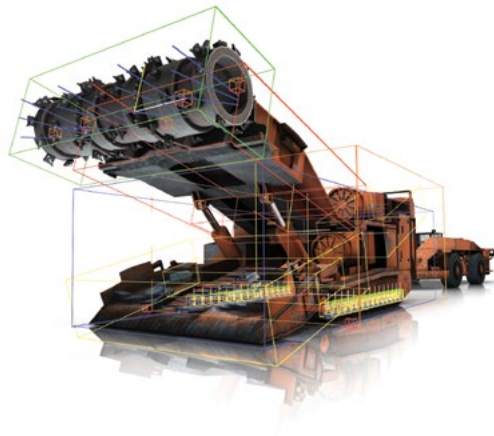
Trainees are exposed to a number of scenarios that they may encounter under real operating conditions:

- Emergency situations
- Critical vehicle failures
- Dykes
- Even and uneven ore faces
- Inadequate ventilation
- Methane levels
- Proximity sensors
- Fall of ground
- Vehicular and pedestrian traffic

## PHYSICALLY ACCURATE VIRTUAL MINE WORLD

Trainee operators are immersed in an extensive high-fidelity 3D mine world projected on the screens surrounding the cab. The simulated mine world comes complete with typical tunnel and face geometry, bolting areas of varying complexities and other essential features typically encountered in soft rock mining. AI equipment and miners may be activated in the world in support of the equipment training and evaluation process. World specific parameters and interactive events can be varied for a broader operator experience.

Custom mine sites may also be created on request, being worlds that appear identical to your mine and operate in accordance with your unique operating conditions, scenarios and procedures.



## TRAINING AND EVALUATION TOOLS TO MAXIMISE SIMULATOR EFFECTIVENESS

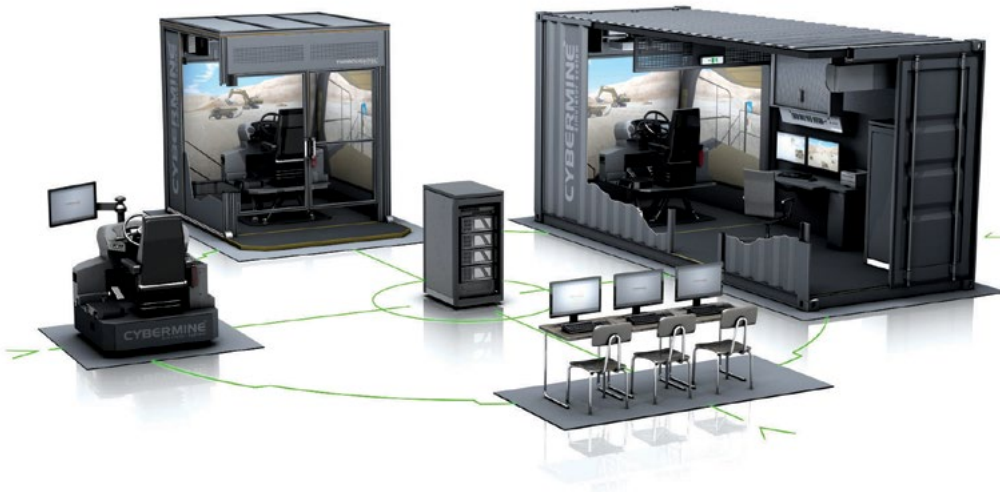
Exercises may be configured to address various training requirements such as main face cuts, box cuts, interactions with AI vehicles and pedestrians and responses to methane alerts. Various equipment faults can be replicated such as a drill bit jam, water pressure failure and air pressure failure (bolter); defective battery charger port, low water pressure and coolant level and thermal overload (continuous miner); burst tyre, cable reel failure, brake failure, headlight failure and steering failure (shuttle car), to name but a few

During the execution of an exercise, the operator's responses are continually monitored and recorded, as are instrument states, controls interaction, adherence to safety procedures, correct equipment handling

techniques and responses to emergency situations and failures.

At the end of each exercise the instructor is provided with reports covering various aspects of operation. Operator evaluation is against a set of predefined checks for the cab type, each categorised into affecting one of health and safety, machine use or productivity enhancement.

These multifaceted performance reports, together with the instructor's after-action review capability, provide a complete training and evaluation system for bolter, continuous miner, plough, shearer and shuttle car operators.



### The Complete CYBERMINE Training Solution

A range of ISO 9001 certified and MIL-STD design engineering compliant training tools linked to a central student database for a seamless progression from new recruit to productive operator

#### > Computer Based Training (CBT)

- Developed in collaboration with recognised training specialists
- Fully interactive multimedia content including photographic still shots, 2D and 3D computer animations and video with audio overlay
- Integrates fully with CYBERMINE FMS and OFT systems
- Wide variety of course topics: Machine introduction, roles and responsibilities, standard operating procedures, occupational health and safety, production techniques and machine operation in emergency situations

#### > Operator Familiarisation Trainer (OFT)

- Familiarises operators with new equipment
- Identification and basic operation of the instruments and controls of a specific machine type
- Utilises interchangeable CYBERMINE vehicle cabs
- Fully adjustable touch-sensitive HD screen
- Exploration, Training and Evaluation modes of operation
- Video and audio feedback to the trainee

#### > Full Mission Simulator (FMS)

- High fidelity simulation for comprehensive operator training
- High resolution projected displays with 270° or 360° field of view
- Utilises interchangeable CYBERMINE vehicle cabs
- Active force feedback steering (as required)
- 6DOF or 3DOF motion platforms
- Spacious instructor station with dual HD screens
- Single base unit provides both surface and underground vehicle simulation
- Containerised or fixed facility units

#### THOROUGHTEC SIMULATION EUROPE, MIDDLE EAST AND AFRICA

Durban, South Africa  
24 Spring Grove, Umhlanga Ridge,  
KwaZulu-Natal, 4319, South Africa  
Tel: +27 (0)31 569 4033  
cybermine@thoroughtec.com  
www.thoroughtec.com

#### Moscow, Russia

1-y Kazachiy Pereulok 7, Floor 1, Room 2,  
119017, Moscow,  
Russia  
Tel: +27 (0)31 569 4033  
cybermine@thoroughtec.com  
www.thoroughtec.com

#### THOROUGHTEC SIMULATION ASIA PACIFIC

Perth, Australia  
Level 14, 197 St Georges Terrace, Perth,  
WA, 6000, Australia  
Tel: +61 (0)8 6141 3326  
cybermine@thoroughtec.com  
www.thoroughtec.com

#### Shanghai, China

Level 20, The Center, 989 ChangLe Road,  
Shanghai, 200031  
People's Republic of China  
Tel: +86 21 5117 5867  
cybermine@thoroughtec.com  
www.thoroughtec.com

#### THOROUGHTEC SIMULATION NORTH AMERICA

Toronto, Canada  
1155 North Service Rd W Unit 11, Suite 67,  
Oakville, ON, L6M 3E3, Canada  
Tel: +1 289 291 3955  
cybermine@thoroughtec.com  
www.thoroughtec.com

#### Salt Lake City, USA

6975 South Union Park Avenue, Suite 600,  
Cottonwood Heights, Salt Lake City,  
Utah, 84084, USA  
Tel: +1 289 291 3955  
cybermine@thoroughtec.com  
www.thoroughtec.com

#### THOROUGHTEC SIMULATION LATIN AMERICA

Santiago, Chile  
Orinoco Street #90 Building 1, 21st Floor,  
Región Metropolitana, Santiago, Chile  
Tel: +56 2 2659 1207  
cybermine@thoroughtec.com  
www.thoroughtec.com

