THOROUGHTEC™
simulation

CYBERMINE™
simulator system

BOLTER SIMULATORS

"When real world training is both dangerous and expensive, simulation is the only viable alternative."

> *Physically accurate vehicle cab*
The trainee operator executes all tramming, drilling and bolting tasks from a highly accurate replica of the cab interior. The seat is surrounded by fully functional controls including steering wheel, switches, gauges, levers, pedals and joysticks.

A SIMULATED VEHICLE THAT LOOKS AND FEELS REAL

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 rock. Inexperienced or incompetent operators cannot be tolerated in this role.

CYBERMINE bolter simulators combine highly advanced simulator technology and sophisticated training techniques to train bolter operators in a virtual world where their mistakes don't endanger lives or affect productivity.

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, and they operate in a high-fidelity 3D mine world where they can tram, drill and bolt, as well as perform mesh handling tasks where required. The simulated bolter interacts with artificially intelligent miners who assist with the drilling and bolting process (if applicable). Other artificially intelligent vehicles complement the experience to provide highly realistic training scenarios.

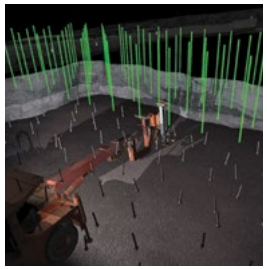
The vehicles, the world and even the operating procedures are highly configurable to a customer's specific needs.

It's in this world that your operators develop their skills and experience, so that your mine site operates as safely and productively as possible.

Operating a CYBERMINE bolter is like operating the real vehicle, but without the high costs and inherent risks.

Authenticity and accuracy
The simulated bolter cab makes use of original components and specifications to create an ergonomically correct and accurate replica of the original vehicle. All simulated vehicle behavioural dynamics are based on detailed mathematical models that use vehicle manufacturer specifications to provide accurate behavioural realism. As a result full collaring, flushing, drilling, bolting and tramming tasks are an accurate reflection of reality.

Highly customisable
CYBERMINE bolter simulators are extremely accurate replications of the original vehicle and can include custom procedural or operational features that have been included on the customer's own equipment or on the customer's own mine site. Any bolter model from any OEM manufacturer can be simulated, along with OEM specified optional features. Both single and dual-boom bolters have been simulated, along with features such as mesh handling, mechanical or manual loading and various bolt types (rebar, Swellex, etc.) tailored to customer-specific requirements.



> *Advanced terrain and systems modelling*
Complementing the equipment simulation are ThoroughTec's advanced simulated rock characteristics (rock hardness and drillability), which interact with realistic modelling of behavioural dynamics and hydraulic systems for a highly realistic drilling and bolting experience. As a result the trained operator is able to exercise correct drilling and bolting techniques for the situation and rock type.

> *Advanced vehicle behaviour modelling*
All simulated bolter behaviour dynamics are based on detailed mathematical models that use vehicle manufacturer specifications to provide realistic behavioural responses of the machine to operator inputs. The bolting simulation takes into account factors such as feed, rotation and percussion pressures, bit rotation speed and wear to provide a realistic drilling experience. As a result, all drilling, bolting and tramming is simulated with realistic audio-visual and tactile feedback for complete immersion in the training scenario.

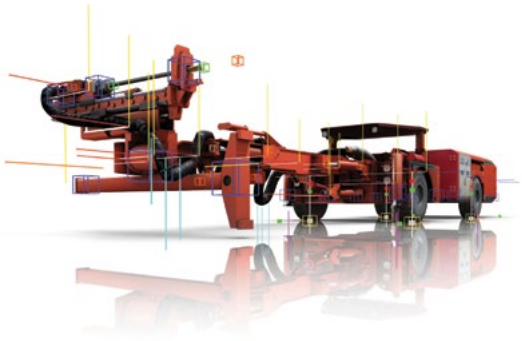
> *Multiple configurable drilling and bolting scenarios*
The virtual world includes a number of bolter scenarios, each set in an appropriate area for the objective, including:
- Simple face on level ground
- Uneven face on level ground
- Simple face on a decline
- Uneven face on a decline
- Cross-cut face
- Base of a decline
- Tramming tunnels

> *Variable world settings*
Trainees are exposed to a number of scenarios that they may encounter under real operating conditions:
- Emergency situations
- Critical vehicle failures
- Varying rock hardness
- Even and uneven faces
- 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 geometry, bolting areas of varying complexities and other essential features typically encountered underground. Artificially intelligent equipment and miners may be activated in the world in support of the bolter training and evaluation process. World specific parameters and interactive events can be varied for a broader operator experience.

A custom mine site can also be created, a world that looks identical to your mine and operates in accordance with your unique operating scenarios and procedures.



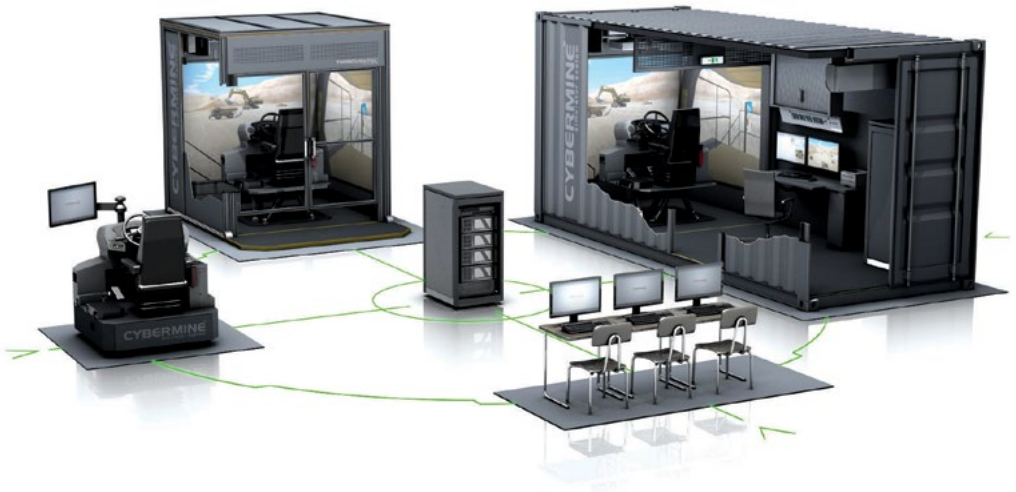
TRAINING AND EVALUATION TOOLS TO MAXIMISE SIMULATOR EFFECTIVENESS

Exercises can be configured to address various training requirements, including operations with different rock characteristics, sub-system failures (such as a drill bit jam, water pressure failure and air pressure failure) and advanced emergency situations such as engine fires or burst tyres.

The operator's tramming, drilling and bolting exercises are continually monitored and recorded, as are instrumentation states, controls interaction, adherence to safety procedures, correct equipment handling techniques and responses to emergency situations and failures. The instructor is also able to continually monitor, in real-time, controls and parameters such as feed and percussion pressure, rotation speed and hole depth.

At the end of each exercise the instructor is provided with a set of reports covering various aspects of operation. For example, productivity reports detail quantifiable returns such as hole position error, drill angle error (pitch and yaw), hole depth, number of holes drilled, number of missed or skewed holes, as well as averages and totals for these quantities. Operator evaluation is against a set of predefined checks for the cab type and each is 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 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

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CYBERMINE simulator system · CYBERQUIP simulator system · CYBERWAR simulator system · CYBERDRIVE simulator system

ISO 9001 · ISO 14001 · MIL STD

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