

THOROUGHTEC[™]
simulation



CYBERMINE[™]
simulator system 

UNDERGROUND TRUCK SIMULATORS

“On simulators we can cost-effectively train our operators for everything they might encounter underground, from routine procedures to emergency scenarios.”

The productivity and safety records of an underground mine operation are directly linked to the skill and proficiency levels of its underground truck operators.

CYBERMINE underground truck simulators use cutting-edge simulator technology and highly sophisticated training techniques to train, re-train and evaluate correct underground loading, hauling and dumping procedures to improve the abilities of underground truck operators.

ThoroughTec's high-fidelity simulators are true to the original vehicle in every way, from the ergonomics of the cab with authentic replication of

the operator interfaces to highly accurate behavioural characteristics of the equipment being simulated. The CYBERMINE underground truck operates in a high-fidelity 3D mine world where it interacts with artificially intelligent pedestrians, underground loaders and chutes, allowing the operators to perform the same full range of functions as they would on the actual machine. Dedicated areas are provided within the operational mine world to provide for the training of various tasks and emergency situations.

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



> Physically accurate vehicle cab

The trainee underground truck operator executes all loading, hauling and dumping tasks from a highly accurate replica of the cab interior. The seat is surrounded by fully functional instruments and controls including steering wheel, joysticks, switches, gauges, levers and pedals.



A SIMULATED VEHICLE THAT LOOKS AND FEELS REAL

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

Authenticity and accuracy

The simulated underground truck cab makes use of original components and specifications to create an ergonomically correct and accurate replica of the original vehicle. All simulated vehicle behaviour, including vehicle articulation and bin dynamics, are based on detailed mathematical models that use vehicle manufacturer specifications to provide accurate behavioural realism. As a result full loading, hauling and dumping tasks are an accurate reflection of reality.

Highly Customisable

CYBERMINE underground truck simulator cabs can simulate any model from any OEM, while functionality can include custom procedures or operational features that have been included on the customer's own equipment. For example, the simulator system can include automatic retarder control systems, customer specified ground speed limits, CCTV driving aid systems and simulated two-way radios.

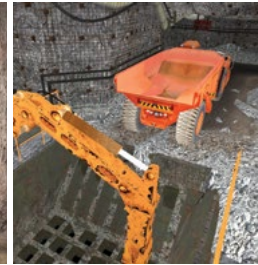


> **Advanced terrain modelling**

ThoroughTec Simulation uses advanced soil and terrain models to complement equipment simulation, such as deformable soil models for the vehicle loading simulation, allowing realistic fill factor calculations.

> **Advanced vehicle behaviour modelling**

All simulated underground truck behavioural dynamics are based on detailed mathematical models that use vehicle manufacturer specifications to provide realistic behavioural responses of the machine to operator inputs. Complicated physical interactions are simulated to an extremely high level of fidelity for realistic audio, visual and tactile feedback during the entire loading, hauling and dumping cycle.



> **Multiple configurable load-haul-dump scenarios**

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

- Chute loading area
- Crusher area for dumping
- Workshop area for parking
- LHD loading area with elevated roof
- Brake test area
- Interlinked tunnels for tramming exercises, including traffic controls
- Mine decline and access tunnels with traffic controls

> **Variable world settings**

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

- Emergency situations
- Critical vehicle failures
- Fall of ground
- Closed or open crusher bays
- Rubble spillages
- Water pools
- Artificially Intelligent traffic

PHYSICALLY ACCURATE VIRTUAL MINE WORLD

Trainee operators are immersed in an extensive high-fidelity 3D mine world based on a typical mining operation complete with tunnels, loading points, chutes, dumping areas and other essential features typically encountered underground. Artificially intelligent vehicles and miners may be activated and interacted with during an exercise in support of the underground truck training and evaluation process. World specific parameters and interactive events can be varied for a broader operator experience, such as rock slides or rubble spillages.

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.



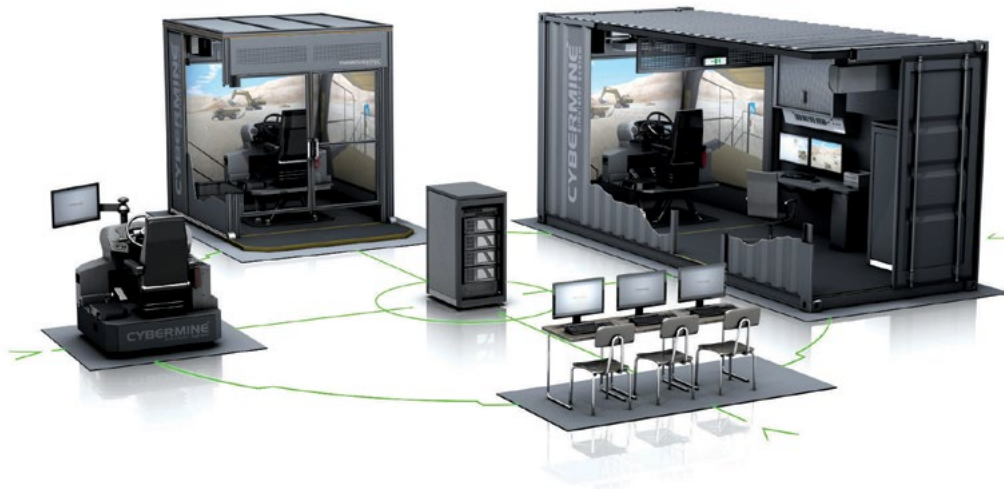
TRAINING AND EVALUATION TOOLS TO MAXIMISE SIMULATOR EFFECTIVENESS

Exercises can be configured to address various training requirements, including operations with different traffic, both vehicular and pedestrian, sub-system failures (such as steering failure or low transmission oil pressure) and advanced emergency situations such as brake failures, engine fires or burst tyres.

The operator's loading, hauling and dumping 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 able to continually monitor, in real-time, controls and parameters such as vehicle and engine speed, selected gear, articulation angle and states of the braking systems. At the end of each exercise

the instructor is provided with a set of reports covering various aspects of operation. For example, a productivity report details quantifiable returns for each load, haul and dump cycle, as well as a summary of productivity related criteria for the exercise. Factors such as number of alignment attempts, time to load, mass of the load dumped, percentage of load dumped, as well as average tonnage and number of cycles per hour, are recorded.

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 provide a complete training and evaluation system for underground truck 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

