

THOROUGHTEC™
simulation



CYBERMINE™
simulator system 

LOCOMOTIVE SIMULATORS

“ When transporting huge loads in an expensive locomotive, the operator needs to be as safe and efficient as possible.”



> *Physically accurate vehicle cab*

The trainee operator executes all loading, hauling and dumping tasks from a highly accurate replica of the cab interior. The seat is surrounded by fully functional controls including joysticks, switches, gauges, levers and pedals. The vehicle's functionality is also customisable to match the customer's OEM equipment for even greater simulation accuracy.



Operating a locomotive in the complex, continually changing environment of an underground mine requires skills honed through intensive training. The quickest and most cost-effective way to achieve this level of training is with a CYBERMINE locomotive training simulator.

CYBERMINE locomotive simulators use sophisticated simulator technology and highly advanced training techniques to train, re-train and evaluate correct loading, hauling and dumping techniques in an underground mining environment, to increase efficiency, productivity and safety.

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 locomotive operates in a high-fidelity 3D mine world where the operator can perform the same full range of locomotive functions as the OEM machine. It consists of tunnels, rails, loading points, chutes, tipping areas, battery bay and workshop. Dedicated areas are provided within the operational mine world to allow for the training of specific hauling, loading and unloading tasks, as well as emergency situations.

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

A SIMULATED VEHICLE THAT LOOKS AND FEELS REAL

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

Authenticity and accuracy

The simulated locomotive cab makes use of original components and specifications to create an ergonomically correct and accurate replica of the original vehicle. Simulated locomotive behavioural dynamics are based on detailed mathematical models to provide accurate realism.

These advanced locomotive reality models calculate the complex interactions between engine, hoppers and tracks, even derailing the loco under extreme

circumstances. As a result, full tramming, loading and unloading tasks are an accurate reflection of reality.

Highly customisable

CYBERMINE locomotive simulators can be customised to include any client-specific procedural or operational features. For example, controls can be configured to meet the behavioural characteristics on the mine site, while optional CCTV driving aid systems or simulated two-way radios can be fitted. Any locomotive model from any OEM manufacturer can be simulated, along with OEM specified optional features.

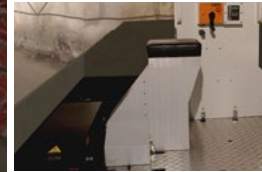


> **Advanced ground modelling**

Complementing the equipment simulation are ThoroughTec's advanced simulated rail interaction models. This requires the operator to exercise correct accelerating and stopping techniques according to the area and type of slope in order to obtain efficient operation factors.

> **Advanced vehicle behavioural models**

All simulated locomotive behavioural dynamics are based on detailed mathematical models that use vehicle manufacturer specifications to provide realistic behavioural responses of the machine to operator inputs. In addition, the locomotive simulation models physical interactions such as between track and bogey. All loading, hauling and unloading is simulated with realistic visual and tactile feedback for a complete immersion into the training scenario.



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

Depending on the locomotive procured, the virtual world includes a number of possible scenarios, each set in an appropriate area for the training objective, including:

- Chutes
- Tipping areas
- Battery bay
- Workshop area
- Interlinked tunnels for tramming exercises

> **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
- Rock slides
- Rubble spillages
- Water pools
- Artificially Intelligent traffic

PHYSICALLY ACCURATE VIRTUAL MINE WORLD

Trainee locomotive operators are immersed in an extensive high-fidelity 3D mine world projected on screens surrounding the cab. The mine site is based on a typical mining operation complete with tunnels, loading points, chutes, dumping areas and other essential features typically encountered underground. Artificially intelligent locomotives, chutes, guard, miners and other such entities may be activated in the world in support of the locomotive training and evaluation process.



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.

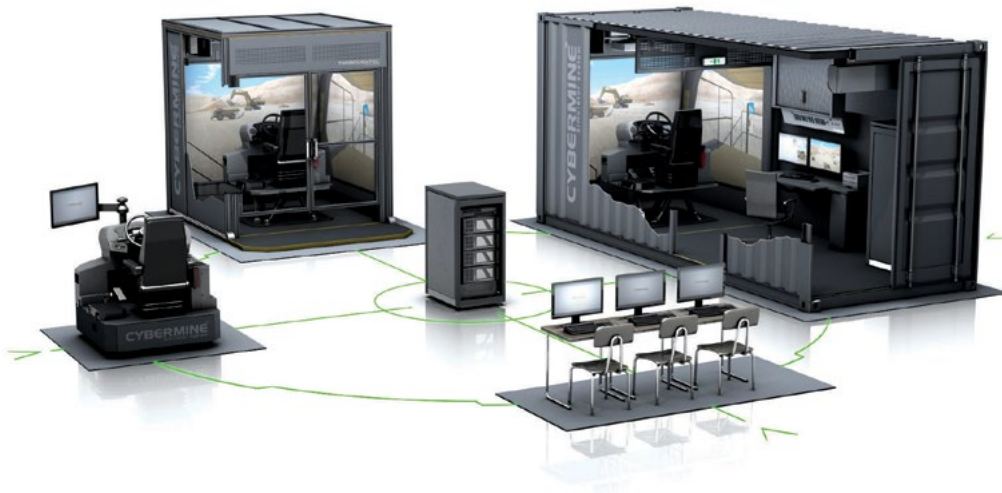
TRAINING AND EVALUATION TOOLS TO MAXIMISE SIMULATOR EFFECTIVENESS

Exercises can be configured to address various training requirements, including operations in areas of differing slopes, and dealing with other vehicles and personnel in the tunnels, sub-system failures and emergency situations such as brake failure or engine fire.

The operator's performance is 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 monitor, in real time, controls and parameters such as vehicle speed and service brake position. At the end of each exercise the instructor is provided with a set of reports covering various aspects of operation that may be used to quantify operator performance.

For example, a productivity report details quantifiable returns for each loading, hauling and unloading cycle, as well as a summary of productivity related information for the exercise. Factors such as correct loading and unloading position, time to load, tonnage loaded and 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, together with the instructor's after-action review capability, provide a complete training and evaluation system for locomotive 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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