

**THOROUGHTEC**<sup>™</sup>  
simulation



**CYBERMINE**<sup>™</sup>  
simulator system 

**HAUL TRUCK SIMULATORS**

**“ When your operator is hauling 300 tons down a low-traction slope in a \$5 million machine, you’ll be glad they’ve done it before in a CYBERMINE simulator.”**

Haul trucks are the backbone of surface mining operations, but for safe and efficient operation you need experience.

By using state-of-the-art simulator technology coupled with equally cutting-edge training techniques, the CYBERMINE range of haul truck simulators allows you to build this level of experience without risking your fleet, your operators or your productivity levels. ThoroughTec’s high-fidelity simulators are true to the original vehicle in every way, from ergonomics and authentic replication of the operator interfaces to highly accurate behavioural characteristics of the equipment being simulated. The CYBERMINE

haul truck operates in a high-fidelity 3D mine world, interacting with artificially intelligent shovels, excavators, wheel loaders and other support equipment in pit, dump and crusher areas. Loading of the haul truck can be via wheel loader, shovel or excavator, using either single or double-sided loading. The number of artificially intelligent haul trucks in operation may also be varied. The vehicles, the world and even the operating procedures can be customised to match your exact mining operation.

It’s in this world that your operators will develop their skills, so that they know what to do when it really matters.



**> Physically accurate vehicle cab**

The student operates from a driver’s seat, surrounded by instruments and controls positioned at ergonomically correct locations. The driver’s interface is accurate down to steering and braking systems, lights, horn, indicators, pedals and gauges, with maximum use of OEM parts for unrivalled accuracy.



## A SIMULATED VEHICLE THAT LOOKS AND FEELS REAL

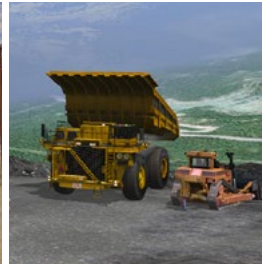
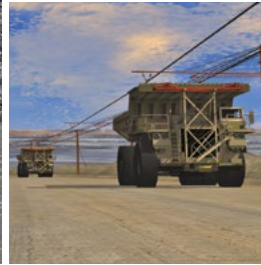
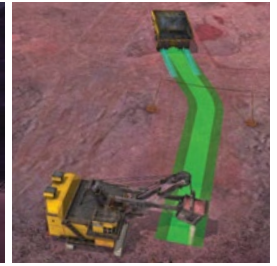
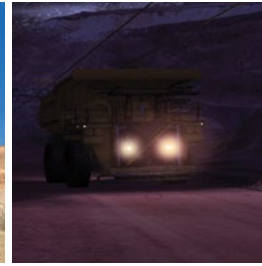
Driving a CYBERMINE haul truck is like driving the real vehicle, but without the high costs and inherent risks.

*Authenticity and accuracy*

The simulated haul truck cab makes use of original components and specifications to create an ergonomically correct and accurate replica of the original. 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 loading, hauling, reversing and dumping capability is included with each haul truck simulation.

*Custom equipment*

ThoroughTec can also customise your haul truck simulator system to match the equipment operating on your mine site, right down to functionality and operating procedures. For example, CCTV driving aid systems, pantograph/trolley assist systems and similar third party sub-systems may be fitted and simulated on request.



> **Advanced soil modelling**

Complementing the equipment simulation are ThoroughTec's advanced soil interaction models incorporating incline, gravity, soil cohesion and density. Dynamic terrain responds to weather conditions, affecting the vehicle's propulsion and braking, while deformable soil allows for realistic loading and dumping.

> **Advanced vehicle behavioural models**

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 loading, hauling, reversing and dumping capability is included with each haul truck simulation. The forces at play in the interactions between wheel, suspension and terrain are accurately modelled for the most realistic operating experience possible.

> **Multiple configurable hauling scenarios**

The virtual 3D world in which the haul truck operates includes a number of hauling and dumping scenarios, each set in a designated area for the objective. This includes:

- Shovel and excavator loading areas
- Stockpile area
- Long haul and short haul exercises
- Visible and blind-side loading
- Crusher area
- Waste dump area

> **Variable world settings**

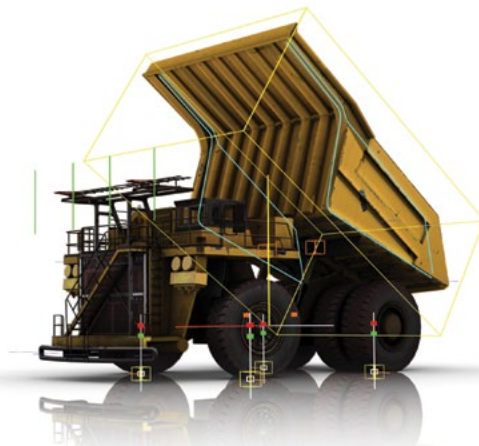
Trainee operators are exposed to a number of scenarios that they may encounter under real operating conditions. These include variations of:

- Light levels
- Visibility
- Weather
- Critical vehicle failures
- Emergency situations, including skidding, tyre bursts and fires
- Artificially Intelligent traffic

## PHYSICALLY ACCURATE VIRTUAL MINE WORLD

Trainee haul truck operators are immersed into a high-fidelity 3D mine site, surrounded by a world populated with artificially intelligent shovels, LDVs, haul trucks, wheel loaders and other support equipment with which to interact in the pit, waste dump, stockpile and crusher areas.

Custom mine sites can also be provided: A world that looks identical to your mine and operates in accordance with your unique operating scenarios and procedures. World-specific features such as cable bridges can be included.



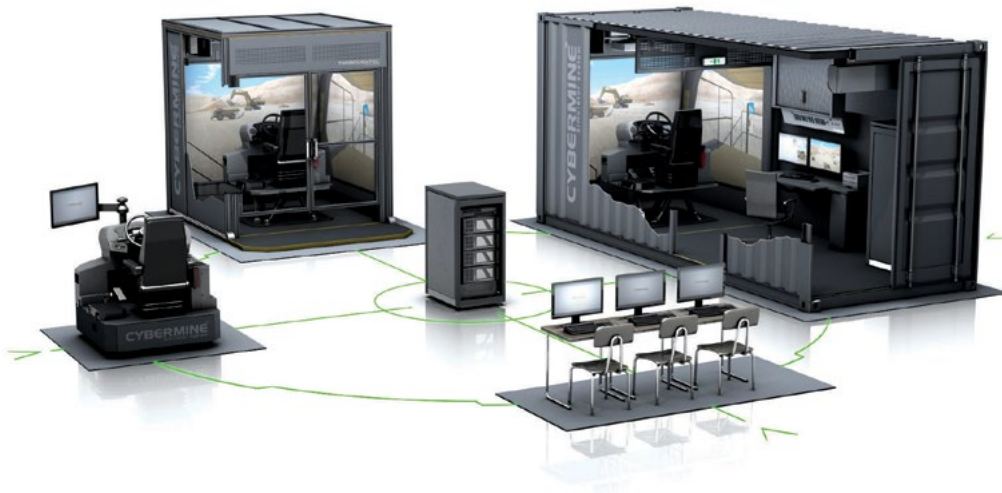
## TRAINING AND EVALUATION TOOLS TO MAXIMISE SIMULATOR EFFECTIVENESS

Exercises can be configured to address various training requirements, including operations with different terrain characteristics such as surface traction, sub-system failures such as steering failure and high hydraulic oil temperature, and advanced emergency situations such as brake failures, engine fires or burst tyres. Various training tools can be enabled by the instructor for specific tasks, including an on-screen reversing aid, mission planner and on-screen displays of spotting or cycle times.

The entire exercise is continually monitored and recorded, including instrumentation states and controls interaction, together with adherence to safety procedures, correct equipment handling techniques and response to emergency situations and failures. The instructor is also able to continually monitor,

in real time, the vehicle speed, engine speed, gear selection and more. 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 such as time to load, time to align, time spent hauling, total tonnage dumped, average tonnage dumped per hour and percentage of load dumped. 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 haul 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

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