

THOROUGHTEC™  
simulation



CYBERMINE™  
simulator system 

DRAGLINE SIMULATORS

**“When a fraction of a percent improvement in productivity adds millions to your bottom line, you’ll be glad there’s an experienced operator at the controls.”**

Draglines are the behemoths of the mining world, weighing up to 8 000 tons and moving vast quantities of materials at a time. The huge price tag and commensurate high cost of inefficiencies and down-time makes effective simulation-based training essential. CYBERMINE dragline simulators use advanced simulator technology and state-of-the-art training techniques to rapidly develop and hone operators’ experience levels without exposing equipment and operators to unnecessary risk or removing operating equipment from the production cycle.

ThoroughTec’s high-fidelity simulators are true to the original vehicle in every way, from the

ergonomics of the cab with authentic replication of operator interfaces to highly accurate behavioural characteristics of the equipment being simulated. The CYBERMINE dragline operates in a high-fidelity 3D mine world where the operator can propel, drag, hoist and swing, interacting with dozers and other equipment. Dedicated areas are provided within the operational mine world to provide for the training of various cuts, maintenance handling and emergency situations.

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



**> Physically accurate vehicle cab**

The trainee operator executes all dragline operations from a highly accurate replica of a typical interior. The seat is surrounded by fully functional controls including switches, gauges, control levers and foot pedals. The vehicle has been engineered to be highly configurable in terms of operational characteristics to match the equipment used on a particular mine site.



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

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

**Accuracy and ability to configure**

Although the CYBERMINE dragline simulator portrays the physical and behavioural characteristics of a generic dragline variant, it has been specifically designed to allow configuration changes by the instructor to behave as a different dragline unit that may be in use on the mine. This flexible configuration is achieved through selectable control of the superstructure swing using either the foot pedals, the left control lever or the right control lever, and adjustment of the drag, hoist and swing characteristics (accelerations and speeds).

The simulated dragline cab makes use of original components and specifications to create an ergonomically correct and accurate replica of the vehicle.

All simulated vehicle behaviour dynamics are based on detailed mathematical models that use vehicle manufacturer specifications to provide accurate behavioural realism. As a result, full bucket control and placement, cuts, excavating of overburden and spoiling exercises are an accurate reflection of reality.



> **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 excavating and dumping.

> **Advanced modelling of ropes and cable systems**  
Crucial to the effective simulation of dragline equipment is the accurate physical modelling of the complex interactions between cables, couplings and bucket structures, together with bucket interaction with the terrain, to provide realistic behavioural response of the dragline to operator inputs. Simulated bucket swing behaviour under various loads and cable lengths has to be close to perfect. No other dragline simulator provides this level of dynamic realism.

> **Multiple configurable cut and function scenarios**  
The virtual 3D world in which the dragline operates features a number of cut and function scenarios, each set in an appropriate area for the objective. This includes:

- Box Cut
- Online Offline Key Cut
- Offline Key Cut and Bridge
- Square Chop and Block
- High spoiling
- Bucket control tasks
- Maintenance of dump rope failure

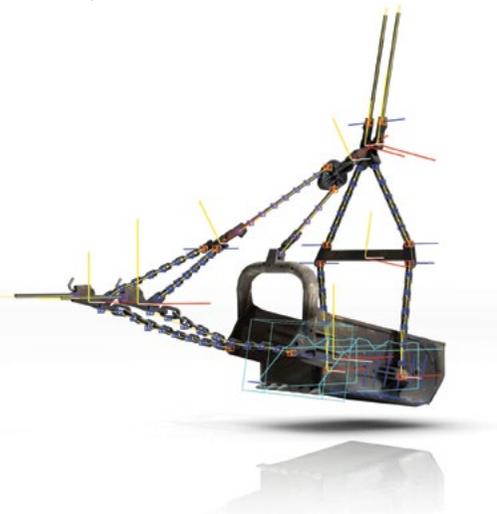
> **Variable world settings**  
Trainees are exposed to a number of scenarios that they may encounter under real operating conditions.

- Light levels
- Visibility
- Weather
- Emergency situations
- Critical vehicle failures
- Visible bench cracks

## PHYSICALLY ACCURATE VIRTUAL MINE WORLD

Trainee dragline operators are immersed in a high-fidelity 3D mine world complete with overburden and spoils and artificially intelligent support equipment commonly seen in the environment. Advanced soil modelling is used for highly realistic interaction between mine world and the dragline. The weather and time of day can be manipulated to cover various operating conditions, while world specific parameters and interactive events can be adjusted for a broader operator experience.

The dragline-specific mine world features key functional training areas to allow for training in all necessary cuts and other functions.



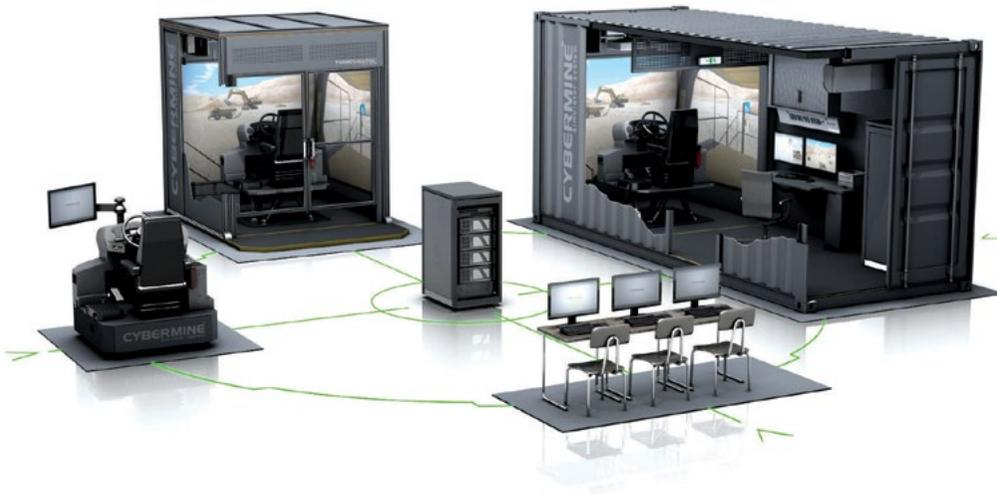
## TRAINING AND EVALUATION TOOLS TO MAXIMISE SIMULATOR EFFECTIVENESS

Exercises can be configured to address various training requirements, including operations with different overburden characteristics, sub-system failures (including broken dump rope, air pressure faults and drag motor trip failure) and advanced emergency situations such as engine fires. Instructors can even adjust the maximum speeds of the swing, drag and hoist drives for the initial development of novice operators' psycho-motor skills under more forgiving conditions.

The entire exercise is continually monitored and recorded, including instrumentation states, controls interaction, bucket orientations and swing speeds, 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 bucket's pitch, roll, relative yaw and fill factor. 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 tons moved, dump cycles, average swing angle, fill time and spot time. 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 dragline 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

