

# Virtual Reality Training

for Cat® Longwall Shearers



# VIRTUAL TECHNOLOGY. SAFE TRAINING. REAL RESULTS.

Operating a shearer means you are at the top of the productivity chain in your mine. It is a responsible task. You have a powerful and valuable machine at your hands and at the same time you are responsible for the safety of people and equipment.

Although highly automated a Cat® Shearer still is a complex machine, especially when you are also responsible for maintenance. Operating the shearer and setting it for full automation also means fine-tuning your longwall operation to highest productivity.

## PRODUCTIVITY IS THE CLASS GOAL

Learning on-site everything necessary to do the job would require one of the most expensive classrooms ever – your mine. Can you afford to train newcomers during actual shearer operation? Would you stop production to have them train maintenance tasks on a shearer?

## VIRTUAL TECHNOLOGY – REAL RESULTS

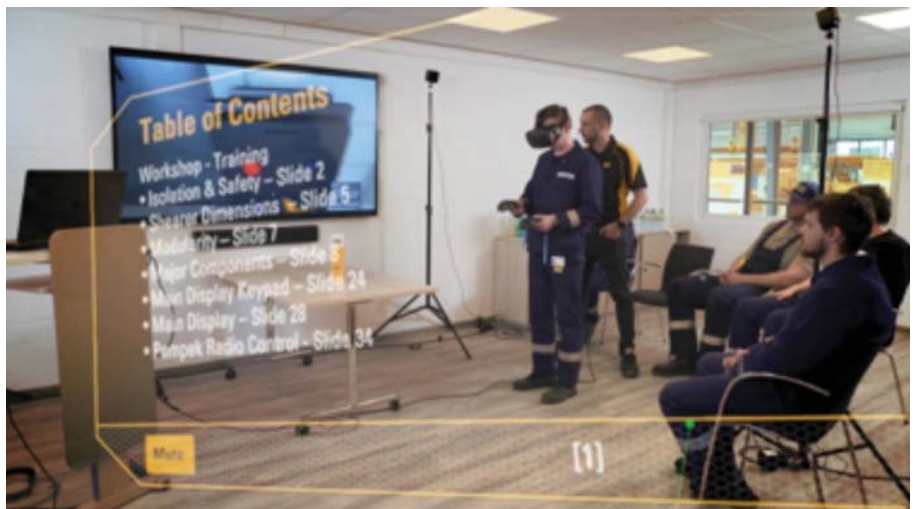
Cat Virtual Reality Training Solutions answer many of the questions and challenges that come with familiarizing the newcomer with shearer maintenance and operation. They lessen the difference between the inexperienced and the experienced miner.

Cat VR Training Solutions do not interfere with production, they do not even require traveling or expensive classrooms. They come in a box and they contain tons of information and experience.

## SAFER TRAINING

Equipment may be cost-intensive, health is priceless. Familiarizing yourself with the shearer should not be done in a tireless and potentially hazardous environment, it must not put at risk people or safety.

Cat VR Training Solutions bring everything you need to know about shearer components and how they work, shearer maintenance and operation to a comfortable and convenient location of your choice.



---

## INNOVATIVE AND ENJOYABLE

VR Training is engaging and exciting. It adapts to the viewing and learning habits of a young generation and thus lowers the entry barriers. At the same time it is intuitive in usage allowing miners of every age and level of experience to work with it.

---

## HIGHLY IMMERSIVE



Cat VR Training offers realistic scenarios that are highly immersive. You will soon forget you are wearing a headset – true-to-life movements with realistic graphics and precision movement tracking will “beam” you right into the shaft, the longwall or the workshop. In your hands controllers can select and use tools or remote controls and will open lids or push buttons. Sensors will track your position and angle, if you are standing or kneeling, and translate it into realistic movements in a virtual environment.

---

## EXPERIENCE BUILDS ON MISTAKES



You can also learn in scenarios that are otherwise impossible. You want to disassemble the shearer with one finger? You want to explore and exceed the limits of shearer operation? Cat VR Training makes it happen. It does not resent mistakes, it transforms them into learning successes.

---

## HIGHEST AVAILABILITY

Train anywhere anytime. Cat VR Training for Shearers comes in a box. It is set-up quickly and does not require extensive knowledge of computers or network technology. It can be set-up literally anywhere and once installed it opens a whole world of possibilities: a full-size coal mine, from locker room to lamp room, down the shaft and into the longwall. And it includes a workshop for shearer maintenance. No other training method can offer that high availability.



---

## SECOND-LEVEL INFORMATION

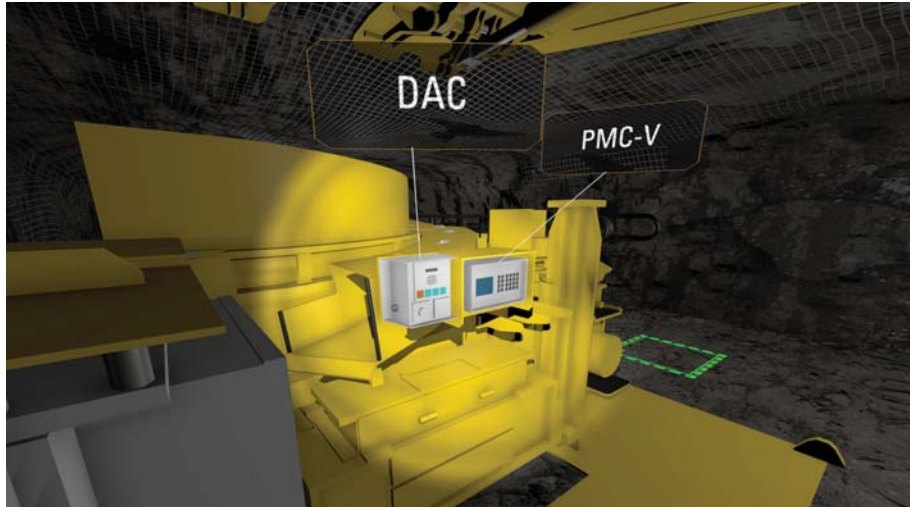
You know that: important information is always missing when you need it and when you are far away from manuals or computers. Cat VR Training gives you second-level information wherever you need it in the virtual mine – text, figures or graphics. This enables you to learn the correct terms, dimensions or performance data directly at the machine for quick reference.

### LEARNING SUCCESS

Learning success only becomes apparent with time. It means the highest possible absorption of knowledge and the ability to apply it. Studies have shown that retention rates for lecture style learning are about 5%, reading rates are about 10% only.

For decades, a combination of listening, reading and viewing (pictures, video) was regarded as the optimum way of imparting knowledge. But according to the 70:20:10 framework, 10 percent of what people learn comes from formal learning events such as courses and classes; 20 percent comes from informal, peer-to-peer learning; and 70 percent is experiential.<sup>1</sup>

Here, Cat VR Training is the ideal solution including all of this plus interaction and direct feedback from the virtual environment. Here, retention rates are estimated at 75%.<sup>2</sup>



---

## ANYTHING BUT ABSTRACT

Cat VR Training Solutions will bring your training as close to reality as can be. Without traveling for hours to the longwall, without interfering with production or putting new miner's health at risk. Scenarios are always realistic, starting with safety instructions and reviews before you enter the mine. We only cut traveling time underground by a virtual "beaming" function – you would not want to waste time on hours of driving or walking underground.

And as training scenarios are always realistic the virtual mine, too, can be customized to match your actual mine layout and technology.<sup>3</sup> You won't get any closer to reality without getting your hands dirty.



<sup>1</sup> See also: *Trainingmag.com*, "The impact and potential of virtual reality training in high-consequence industries", Jan 25, 2018.

<sup>2</sup> See also: Virtual Reality & Learning Report, MASIE Center 2017.

<sup>3</sup> Available on demand.

---

## BASED ON ACTUAL CAD DATA AND MINE LAYOUTS



Cat VR Trainings are realistic because they come from reality. VR mining technology is based on actual, highly detailed CAD data. Mine layouts are taken from actual mines or can even be adapted to your exact mine layout.

Interaction of equipment and geology was designed according to real-life mining experience and production records.

---

## SHARE LESSONS LEARNED



The VR headset offers an immersive, self-contained environment. But Cat VR Training Solutions do not blank out real life valuable experience. On a separate PC monitor, a small laptop or a big screen, your teacher and your colleagues can see what you see and do.

They will learn from your experience in the VR environment and they can help you with their experience. You will do the work together.



# COMPREHENSIVE CONTENT

The road map of Cat VR Training for Shearers follows the training career and daily routines of an experienced operator. Training units are available for Basic Level, Advanced Level and Customized Level.

## PHASE 1:

### EL1000 TRAINING

- + Introduction to mine and workplace safety
- + Shearer introduction
- + Pre-start activities
- + Basic machine operation

## PHASE 2:

### MAINTENANCE FAMILIARIZATION

- + Preventive maintenance
- + Major component replacement
- + Electrical maintenance

## PHASE 3:

### MAINTENANCE SERVICES TRAINING

- + Troubleshooting
- + Unplanned maintenance

### ADVANCED OPERATION TRAINING

- + Mine specific operational training
- + Automation details

## PHASE 4:

### FUTURE SIMULATION DEVELOPMENT

## GETTING STARTED

Safety first. It is simply mandatory before jumping to the workshop or the longwall. So, new trainees and more important, new hires at your mine, will have to pass the main and vital safety procedures before entering the elevator.

Helmet, lamp, gloves and CO<sub>2</sub> filter – trainees need to collect them and put them on, just as signing in to the mine's register (roll of names). And then your virtual shift starts at the elevator door.





# BASIC LEVEL – PHASE 1



## GET TO KNOW THE SHEARER

You can travel to the longwall immediately and closely examine the shearer before operation. All components will identify themselves by 2<sup>nd</sup> level information tags. All controls, remote or on board, are functional. Readings and adjustments are based on real process data. This will give you a good overview and it trains the daily visual examination. But to fully explore the components and functions of the shearer you might as well take a quick break and 'beam' to your very own...



## VIRTUAL WORKSHOP

Just select components with your virtual hands to closely examine them or to gain access to 2<sup>nd</sup> level information. You may start with complete modules like a ranging arm and you can work your way down to plugs, picks or screws.

All essential parts can be selected. And by selecting the right tool from your virtual workbench you can also remove or replace parts.

You will never see your shearer like this in real life. You would never get such an overview underground.





Two virtual hands let you grasp and operate controls

## PREPARE FOR HIGH PRODUCTIVITY

The visual inspection of the shearer in the longwall is followed by pre-start checks.

Next you familiarize yourself with the controls, onboard and remote.

Now, you are in for a real 'manual training': In a 'hands-on' environment you can touch and grasp control elements and remote controls and actually operate the shearer.

Two virtual hands and a 360 degree virtual environment put you directly in the longwall, to the control of the shearer.

Practice a few passes and cutting depths and familiarize yourself with the response and the results.

## ADVANCED LEVEL



In a life-size VR environment you can realistically practice maintenance work at the correct position

## MAINTENANCE AND OVERHAUL

Lubrication, oil levels and hydraulic fluid levels – these will be regular points of interest and tasks for maintenance of the shearer. Cat VR Training Solutions help you identify those valves and sampling points in a life-size environment, just as if you were standing in front of a real shearer.

## LIFE-SIZE REALISTIC ENVIRONMENT

Other regular check-ups or replacements, e.g. inspecting the shear shaft, can be practiced in the same realistic environment.

### PRE-OPERATION CHECKLIST (EXTRACT)

- + Check the shearer for any visible defects, e.g. cracks, leakages, broken or missing parts or wear
- + Check oil and hydraulic fluid levels – Fill up if necessary – Grease the grease nipples as stated in the maintenance tables
- + Check that the cutting drums can rotate freely
- + Check all flameproof covers, cable inlets, safety equipment, controls and inspection covers for damage
- + Check that the water supply is correct to all parts of the shearer
- + Check that the emergency stop is working correctly
- + Check if further maintenance is necessary in accordance with the maintenance tables (...)



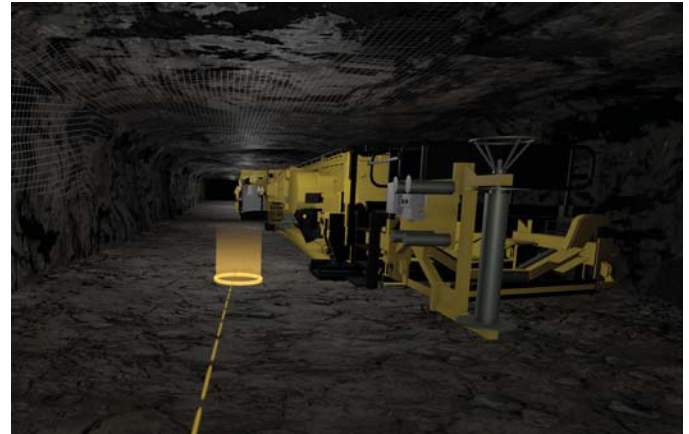
# CUSTOMIZED LEVEL

## EXACTLY YOUR MINE, EXACTLY YOUR EQUIPMENT, YOUR VERY SUCCESS

Cat VR Training Solutions can be sized and customized to your needs. The face length and seam height may be two parameters you may want to adapt as they have an influence on shearer operation.

But also other sections of the mine or parts of the equipment can be customized, e.g. the gate end or the crusher and stage-loader section.

Cat VR Training Solutions are made by Caterpillar. They are made according to your requirements.



'Beaming' to your gate end.

## STAY IN TRACK: ASSESSMENTS

Learning objective controls should accompany every training process, virtual or not, for good reason: they are an important feedback for trainees and teachers on their performance and they are important to keep a record of each individual training career.

Cat VR Training Solutions come with assessments tailored for the objectives and the contents of the virtual lessons.



## OUT OF THE BOX

The equipment necessary for Cat VR Training Solutions is easy to obtain and can be bought at your discretion: a laptop to specification and the HTC Vive set. Caterpillar provides the VR software through an .exe-file that can be purchased, rented for a specific period and even can be tested in advance as a trial version.

**Shearer proficiency needs to be practiced. Let it take place in your virtual longwall and workshop.**

**When your people, new hire or new to the job, go down into the real mine it will be as if they have been there before, as if they have worked with that equipment before. This will be your cutting edge in safety and productivity.**

**Don't repeat tutorials, trials or errors on-site. Just go ahead with operating that shearer at maximum safety and efficiency.**



# CAT VIRTUAL TRAINING SOLUTIONS.

## REAL TRAINING.

## REAL SUCCESS.

### RECOMMENDED PC/LAPTOP MINIMUM SPECIFICATIONS 11/2018 (FOR OPERATION WITH HTC VIVE PRO)

Graphics	NVIDIA GeForce® GTX 1080
Processor	Intel i7
Memory	16GB
Video output	HDMI, Mini Display port, Thunderbolt and Display Port
USB	USB 3 × 2
OS	Windows 10

Contact your local Cat dealer for more details on hardware specs, licensing and pricing.

## TRAINING IN DETAIL

### SHEARER ELECTRICAL TRAINING

Part 1	Control Box ECB3
Part 2	Main Power
Part 3	Control Voltage
Part 4	Pilot Control
Part 5	Watchdog Control
Part 6	LEDs and Fuses
Part 7	Radio Control System
Part 8	Mobile Machine Control Overview
Part 9	IS Power Supply
Part 10	Display and Keyboard
Part 11	Allen Bradley PLC
Part 12	Ethernet Switch
Part 13	Ethernet Power
Part 14	IPC – Mark Up
Part 15	CIOS Module
Part 16	Motor Data Transmitter
Part 17	Motors
Part 18	Hydraulics
Part 19	Transducer
Part 20	Encoder
Part 21	Ground Fault Monitoring
Part 22	End Display
Part 23	PLM
Part 24	Breuer Drive Basic

### SHEARER MECHANICAL TRAINING

Part 1	Mainframe
Part 2	Ranging Arm 560
Part 3	Haulage Unit 100
Part 4	Down Drive 100
Part 5	Power Pack 2
Part 6	Water Circuit
Part 7	Lubrication System

### SHEARER OPERATIONAL TRAINING

Part 1	Machine Operation
--------	-------------------





For more complete information on Cat products, dealer services and industry solutions, visit us on the web at [www.cat.com](http://www.cat.com)

AEXQ2550

© 2019 Caterpillar. All Rights Reserved.

Materials and specifications are subject to change without notice. Featured machines in photos may include additional equipment. See your Cat dealer for available options.

CAT, CATERPILLAR, LET'S DO THE WORK, their respective logos, "Caterpillar Yellow," the "Power Edge" and Cat "Modern Hex" trade dress as well as corporate and product identity used herein, are trademarks of Caterpillar and may not be used without permission.  
[www.cat.com](http://www.cat.com) [www.caterpillar.com](http://www.caterpillar.com)

