

CC ENGINEERS PVT. LTD.

Complex Systems Simplified; Through Simulation.



MAINTENANCE TRAINING & SIMULATION

Maintenance Simulator

RAMS Through Advanced Simulation Training

Simulators that enable technicians to enhance reliability, availability, maintainability and safety by using their skills and knowledge in a safe and controlled setting, and to receive feedback.



RAIL



NAVAL



LAND



AEROSPACE



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INTRODUCTION

What is a Maintenance Simulator?

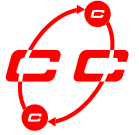
The Maintenance Simulator is a training solution that teaches maintenance and operations staff processes to service and troubleshoot vehicle and platform systems in a safe and efficient manner. It uses a realistic and interactive environment that mimics the actual system and its sub-systems. It also uses VR and AR technologies to improve learning and engagement.

It is positioned as a training solution for maintenance and operations staff - helping them learn servicing, troubleshooting and system operation in a realistic and controlled environment.

SUPPORTS TRAINING IN

- | | |
|---------------------------------------|-------------------|
| ■ Corrective | ■ Operations |
| ■ Servicing | ■ Troubleshooting |
| ■ System & sub-system familiarisation | |
| ■ Safe procedural practice | |
| ■ Interactive learning | |
| ■ Overhaul of systems | |
| ■ Preventive Maintenance | |
| ■ Predictive Maintenance | |

Covers rail, aerospace, naval and land platforms - rail is the deepest body of delivered evidence, not the whole scope.



OVERVIEW

A step towards digital twinning

CC Engineers' maintenance simulators give maintenance engineering teams a risk-free, always-available training environment that replicates the full functional behaviour of a vehicle's or platform's sub-systems.

From routine inspection procedures to complex fault diagnosis using AR overlays, they reduce dependency on physical assets for training while improving technician competency and reducing mean time to repair.

Value

- Risk-free, always-available training that does not require the live vehicle or platform
- Combines physical replicas, digital simulation, instructor control and interactive interfaces, not software alone
- Instructor-controlled fault injection, scenario control and objective performance assessment
- AR-guided procedures on actual hardware for field maintenance support
- Reduced downtime and reduced dependency on operational assets for training
- The essential step towards digital twinning of maintained assets



MTTR

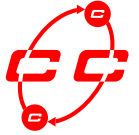
AR-guided procedures on actual hardware for field maintenance support



SAFETY

Detailed practice and reinforced safety principles ensure compliances

Every simulator ships with instructor-controlled fault injection and SCORM-compliant logging, so training outcomes are measurable, not anecdotal.



APPLICATION

Vehicle & platform types

The Maintenance Simulator concept spans multiple domains - aerospace, land, naval and rail.



Aircraft Systems



Tactical Land Vehicles



Complex Naval Systems



Metro Train / Vande Bharat Train Set / Locomotive / DEMU / EMU - MEMU

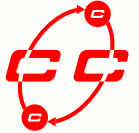


Rail applications include Metro Train, Vande Bharat Trainset and Locomotive - the largest body of delivered systems.

04

domains covered by one simulator concept - aerospace, land, naval and rail - each built on the same physical, digital and immersive training layers.





POSITIONING

What we deliver



Maintenance simulators in railways, defence, and complex systems offer 3D simulations, aiding in predictive maintenance, design enhancements, and improving troubleshooting, fault removal, and corrective actions.



CAPABILITIES IMPLIED BY THIS

- | | |
|------------------------------|----------------------------------|
| ▪ Dynamic simulation in 3D | ▪ Predictive maintenance support |
| ▪ Design enhancement support | ▪ Fault Troubleshooting training |
| ▪ Overhaul training | ▪ Corrective action training |

3D

Every sub-system in scope is represented as a fully explorable 3D simulation, the foundation for predictive maintenance, design-enhancement review and diagnostic training alike.



COVERAGE

Vehicle sub-systems & functional areas

Systems that can be represented within the Maintenance Simulator.

HVAC

Heating, ventilation and air-conditioning systems.

Brakes and Pneumatics

Brake and pneumatic systems.

Doors

Train door systems.

Bogie and Suspension

Bogie and suspension systems.

Gangway

Train gangway systems.

Couplers (TCMS)

Train coupling systems.

Additional Systems & Functional Areas

Traction Motor & Gear Case

Heating, ventilation and air-conditioning systems.

Converter – Inverter

Training related to converter and inverter systems.

Alarm Information System (PAPIS)

Training related to alarm and information systems.

Complex Control and Management Systems

Training for complex control and management systems.

Vehicle Control

Vehicle control system training.

Automated Operations

Training or simulation of automated operations.



COVERAGE

Extended sub-system library

Deployed on rolling-stock programmes.

- TCMS & Vehicle Control Computer (VCC)
- HVAC Systems
- Automatic Door Systems
- Braking Systems (EP, EDB, EBCU)
- Traction Motor & Drives
- Auxiliary Power Supply
- PAPIS (Passenger Audio/Visual Information System)
- Propulsion System
- Bogie & Suspension
- Pneumatic Supply & Distribution
- Pantograph & Catenary Interaction
- Fire Detection & Suppression
- UTO (Unattended Train Operation) Systems
- Gangway & Coupler Systems





MAJOR COMPONENTS

Physical & digital training environment

The Maintenance Simulator is not purely software based. It can combine physical replicas, digital simulation, instructor control and interactive training interfaces.



TRAINEE INTERFACE

Trainee Interaction Desk

A part of the maintenance simulator with a computer, a monitor and other interaction devices that allow the trainee to interact with simulated sub-systems.



CONTROL

Controlling Instructor Station

A part of the maintenance simulator with a computer, a monitor and other interaction devices that allow the trainee to interact with simulated sub-systems.



PHYSICAL

Scale-Down Functional Physical Replicas

A part of the maintenance simulator with a computer, a monitor and other interaction devices that allow the trainee to interact with simulated sub-systems.

Through the trainee interaction desk, the trainee can



View 3D models of sub-systems



Use buttons and switches



Use VR trainers



Follow on-screen instructions



Use AR trainers



Use a QR code scanner



Use a webcam

The Trainee Interaction Desk connects to the Controlling Instructor Station and the Scale-Down Functional Physical Replicas.



CAPABILITY

Interactive Simulation Capabilities



Free Exploration of the Train in a 3D Virtual Environment

The trainee can explore systems and environments digitally in 3D.

Information Mode

A dedicated interface where trainees can access information associated with sub-systems.

Normal Operations Simulations

Simulates normal operations so trainees understand expected operational behaviour before dealing with fault conditions.

Software Logic Flow Chart Simulation

Represents and simulates software logic flows, supporting understanding of system logic, control behaviour and operational sequences.

Circuit Simulation

Training through electrical or system circuit simulation, helping trainees understand behaviour and troubleshoot faults at circuit level.

Fault Diagnosis and Troubleshooting

One of the primary functional purposes of the Maintenance Simulator.

Dynamic Simulation in 3D

The trainee can explore systems and environments digitally in 3D.

3D Procedures Training

A dedicated interface where trainees can access information associated with sub-systems.

Computer Based Training (CBT) Modules

Video-based learning modules for preventive maintenance activities.



COMBINED MODE

Combined Mode Operation of the Train

The simulator also includes training for Combined Mode Operation of the Train - layering the nine interactive capabilities together so trainees practise across sub-systems in one continuous session rather than in isolation.

DRAWS ON

- Free Exploration of the Train in a 3D Virtual Environment
- Software Logic Flow Chart Simulation
- Dynamic Simulation in 3D
- Fault Diagnosis and Troubleshooting
- Video Based Training Modules for Preventive Maintenance (CBT)
- Information Mode
- Circuit Simulation
- 3D Procedures Training
- Normal Operations Simulations





IMMERSIVE TRAINING

Virtual, Augmented & Mixed Reality Modules



Virtual Reality (VR) Modules

VR can be incorporated into the training environment to improve learning and engagement.



Augmented Reality (AR) Modules

AR or Mixed Reality can be used to enhance the maintenance training environment.

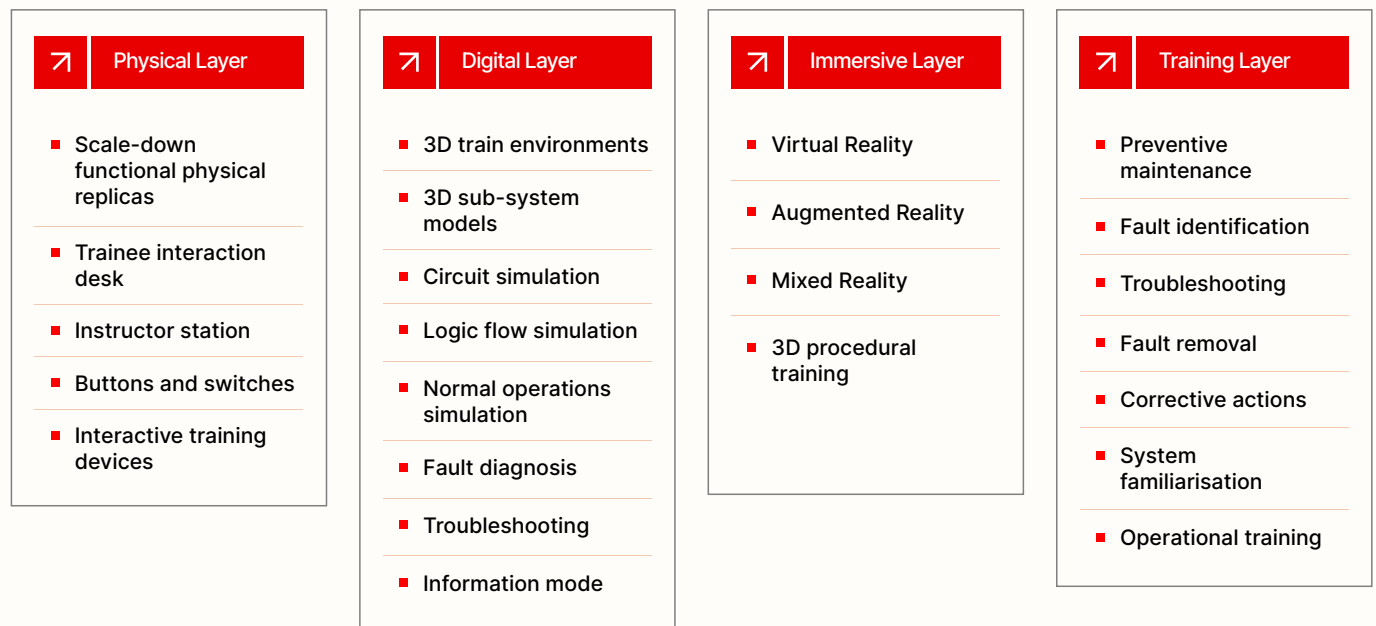
A webcam and a QR code scanner support VR / AR training use. Virtual, Augmented and Mixed Reality are part of a broader maintenance training ecosystem, not the whole product.



STRUCTURE

Overall product capability structure

The Maintenance Simulator combines four layers into one training environment.



Delivery configurations

Full Locomotive Maintenance Simulator Complete virtual replica of the locomotive or trainset, enabling end-to-end maintenance training across all sub-systems.	Sub-System Simulator Dedicated simulator for a specific sub-system such as braking, HVAC or propulsion, ideal for specialist training programmes.	AR Maintenance Trainer Augmented-reality overlay on physical hardware components; technicians point their device to receive instant component identification, fault indicators and step-by-step maintenance procedures.	Virtual Maintenance Simulator Software-based VR maintenance environment accessible on standard workstations, tablets and VR headsets.
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APPLICATION

Where it is applied

➤	Initial maintenance-technician training for new vehicle / platform induction
➤	Recurrent competency assessment for maintenance engineers
➤	Fault-finding and diagnostic skills development
➤	Preventive maintenance procedure training
➤	Pre-overhaul familiarisation for depot staff
➤	TCMS and control-system training without access to actual vehicles
➤	AR-guided field maintenance support for technicians

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CREDIBILITY

Why CC Engineers

Founded in 1987 and headquartered in Pune, Maharashtra, CC Engineers Pvt. Ltd. designs, manufactures and delivers dynamic simulators and technology-intensive customised projects for the transport and defence industries.



In-house engineering

- Civil
- Mechanical
- Electrical
- Electronics
- Computer engineering
- Software
- Manufacturing
- Turnkey project execution



Services

- Software Development
- Modeling for Simulations
- Turnkey Project Execution
- Design, Development & Innovation
- Manufacturing
- Civil Engineering



Certifications

- ISO 9001:2015
- MSME registered
- NSIC registered

Clients



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FAQ

Can your maintenance simulators support metro trainsets?

Yes. Deployed for metro systems including Mumbai Metro Lines 2 & 7 (MMRDA/BEML) and LMRC-Alstom trainsets. Custom models match the specific rolling stock.

How does fault injection work?

The instructor can inject single or multiple faults into any sub-system at any time. The trainee identifies the fault using diagnostic procedures and takes corrective action. All fault scenarios are logged for assessment.

Train your maintenance teams before you touch the asset.

Physical, digital and immersive - one maintenance training ecosystem.



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