Motion-High Speed Train Simulator manufactured by Simutech
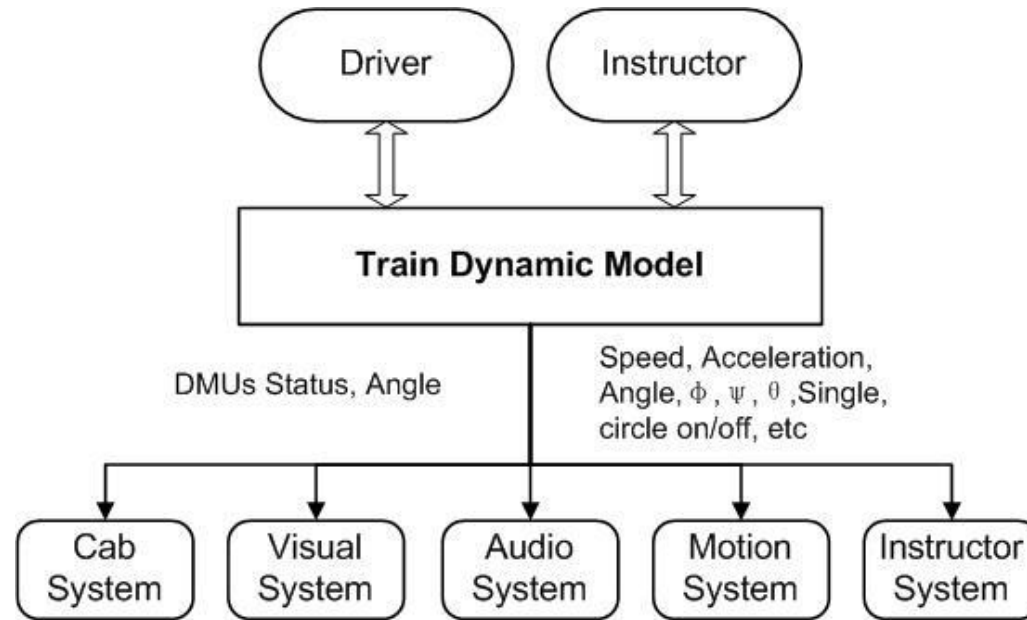
2. CONFIGURATION OF THE MOTION-HIGH SPEED TRAIN SIMULATOR

The simulator is a hardware and software integration system including different technologies of mechanical, hydraulic, optic, electric, and electronic, computer and digital control. The simulator is divided into 3 main subsystems as: **control, observer** and **trainee** stations.

- ✧ Control Stations (Instructor Console System)
- ✧ Observer Stations (Debriefing Stations)
- ✧ Trainee Stations

The system has overall 12 sub group systems as follows:

- ✧ Simulated Cab System
- ✧ Computer System
- ✧ Train Dynamic Model Software System
- ✧ Visual System
- ✧ 6-DOF Motion System
- ✧ Audio System
- ✧ Instructor Console System
- ✧ Communication System
- ✧ Electric and Illumination System
- ✧ Interface System
- ✧ Debriefing system
- ✧ Auxiliary system

Driver Instructor

Train Dynamic Model

DMUs Status, Angle

Speed, Acceleration, Angle, ϕ, ψ, θ, Single, circle on/off, etc

Cab System Visual System Audio System Motion System Instructor System

Train Dynamic Model Parameter Diagram

Images from the Motion-high Speed Train Simulator System:

Motion Train Simulator Cabin System

Instructor System

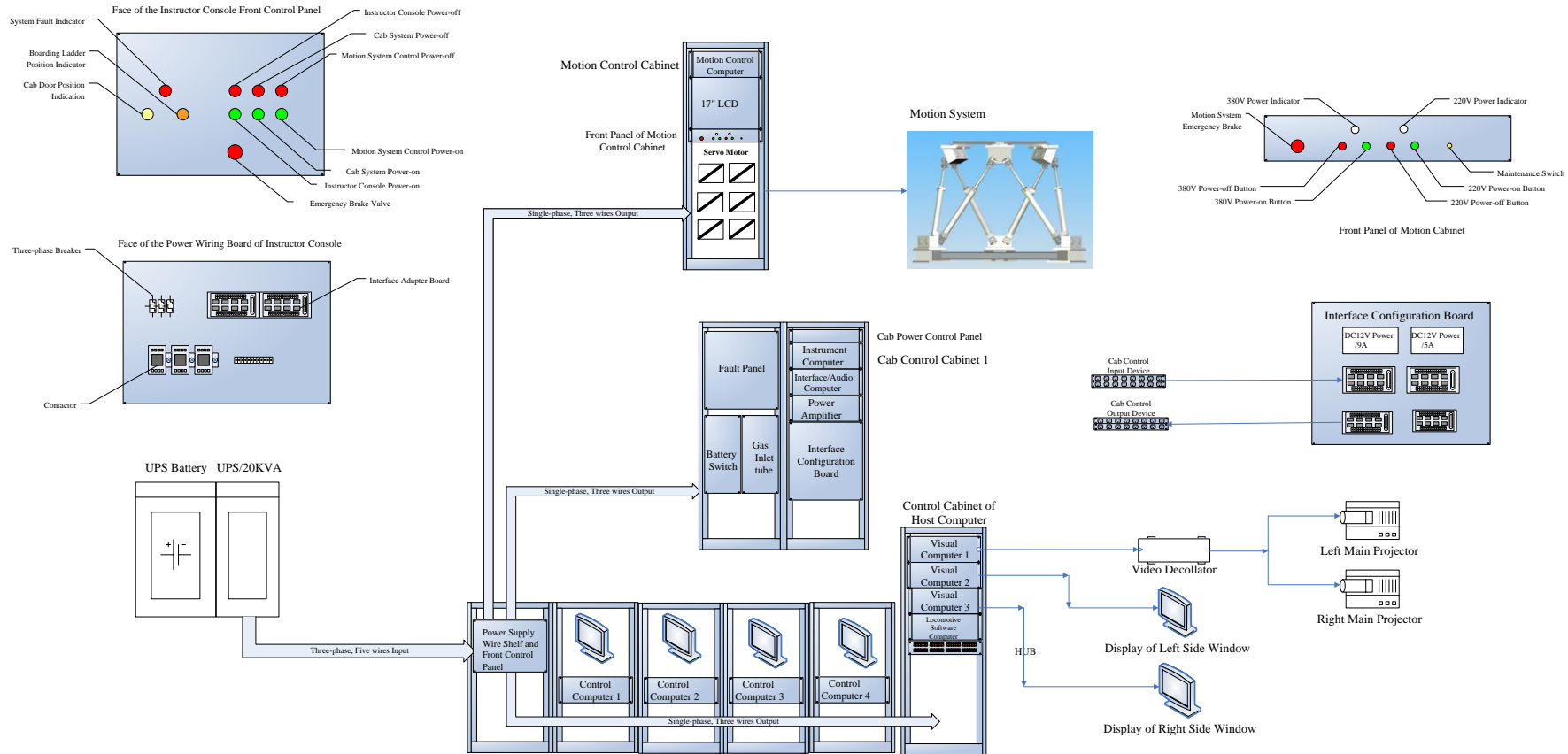6-Axis (6-DOF) Motion System

Debriefing System

Visual System

Instructor Console Typical Page

Hardware Configuration Diagram

Face of the Instructor Console Front Control Panel

System Fault Indicator

Boarding Ladder Position Indicator

Cab Door Position Indication

Instructor Console Power-off

Cab System Power-off

Motion System Control Power-off

Motion System Control Power-on

Cab System Power-on

Instructor Console Power-on

Emergency Brake Valve

Face of the Power Wiring Board of Instructor Console

Three-phase Breaker

Interface Adapter Board

Contactor

UPS Battery   UPS/20KVA

Three-phase, Five wires Input

Power Supply Wire Shelf and Front Control Panel

Motion Control Cabinet

Motion Control Computer

17" LCD

Servo Motor

Front Panel of Motion Control Cabinet

Single-phase, Three wires Output

Motion System

Cab Power Control Panel

Cab Control Cabinet 1

Instrument Computer

Interface/Audio Computer

Power Amplifier

Fault Panel

Battery Switch

Gas Inlet tube

Interface Configuration Board

Single-phase, Three wires Output

Control Cabinet of Host Computer

Visual Computer 1

Visual Computer 2

Visual Computer 3

Locomotive Software Computer

HUB

Control Computer 1

Control Computer 2

Control Computer 3

Control Computer 4

Single-phase, Three wires Output

380V Power Indicator

Motion System Emergency Brake

380V Power-off Button

380V Power-on Button

220V Power Indicator

Maintenance Switch

220V Power-on Button

220V Power-off Button

Front Panel of Motion Cabinet

Interface Configuration Board

DC12V Power /9A

DC12V Power /5A

Cab Control Input Device

Cab Control Output Device

Video Decollator

Left Main Projector

Right Main Projector

Display of Left Side Window

Display of Right Side Window

2.1 SIMULATED CAB SYSTEM

It is direct interface between trainee and Simulator and designed for high fidelity feeling to the trainee. It is also an assembly plant for other Simulator subsystem. The Simulator 1:1 mock-up driver desk installed in cab provides realistic control and seeing effect, i.e. the instrument dynamic parameter variety, real control feeling, real position and real appearance. All the appearance of High Speed Train driver desk in real High Speed Train will be simulated in inner front cab.

Figure Cab replica

2.2. COMPUTER SYSTEM

The whole system can be divided into hardware and software systems. In Simulator, first design idea of this system focuses on real time calculation and Simulator system control, and then the subsystem design. To satisfy Simulator high requirement, i.e. large-calculation for different models especial train dynamic model, database management, system control, digital communication, data input and output, etc, the high-performance computer that based on the PC technology is adopted. The software of real time management system is an especial software system of Simulator. It is the base of Simulator software management to fulfill all functions. Real-time management software is the control center of Simulator.

2.3. VISUAL SYSTEM

Visual system is designed to simulate realistic scene changes in various drive conditions and texture of scene including visual effect of various driving parameters under different meteorological conditions, motion effect of their relative movement and the settings of the field. Visual system consists of Digital Image Generator (IG), terrain database modeling software, real-time scene management software, and image display system. It creates highly realistic visuals to suit all of the training requirements.

Different weather status images are shown below;

Clear Sky

Twilight

Fog

Rain

Figure 8-3

Figure 8-4

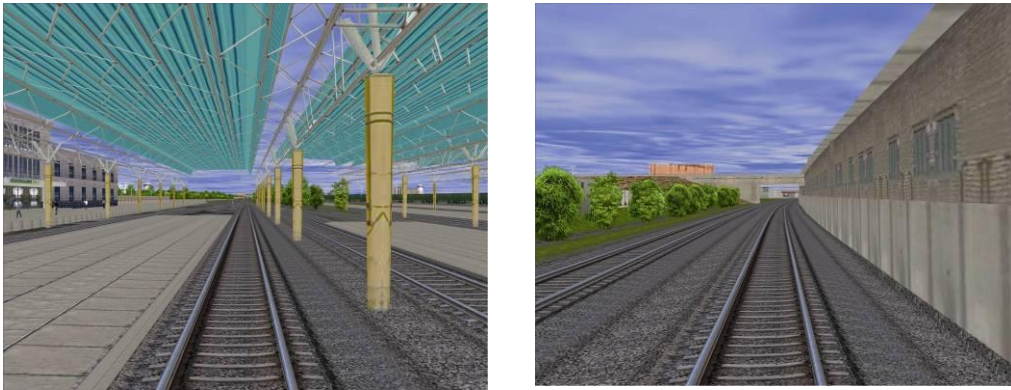✧ Building: house, structures, station buildings, etc.

Figure 8-5

✧ Station facility: station, rails, switch, secondary rail, track/rails, train, passenger wagon, other wagons, etc.
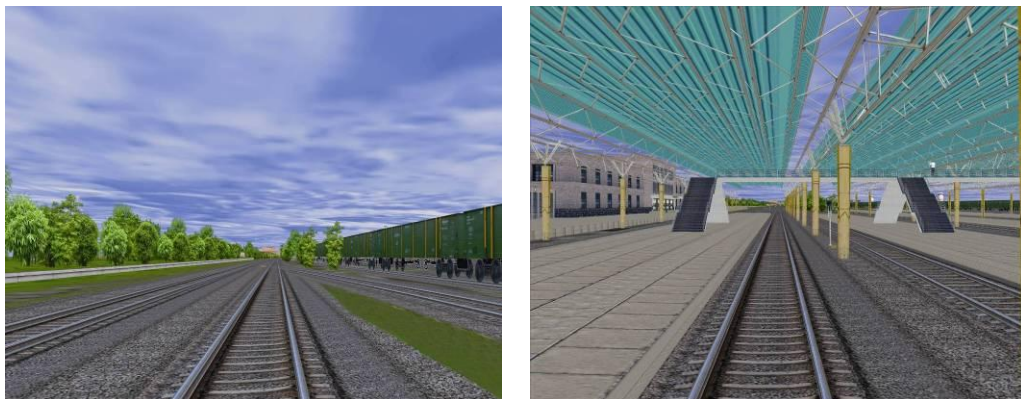

Figure 8-6

2.4 Creation of Computer Track Database and Driving Software

✧ **Summary Regarding the Track Builder Software – CGI Editor**

➢ Allows creation of completely functional railway, with the engineering precision required for track building and re-modeling projects.
➢ Provides standardized data in the bottom of software to ensure the reasonableness of the particular terrain.
➢ After previous application, the software has been validated on the good flexibility to meet the training needs and convenience for users.

2.5. 6-DOF MOTION SYSTEM

Simutech company is highly experienced regarding the manufacture of Motion High Speed Train Simulator and the mentioned motion simulators are successfully serving the Railroads Authorities especially in China and at the Ministry of Transport in Iran.
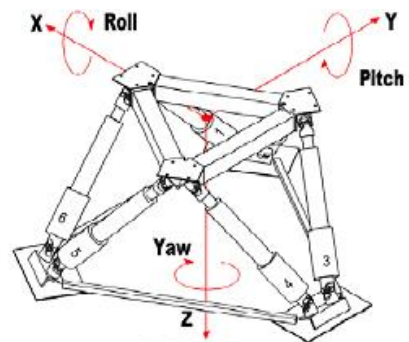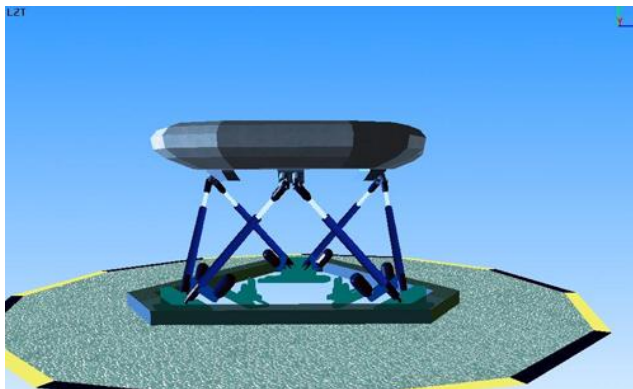

Figure 9-1: Typical Motion System and its Related 6-DOF