Esimtech
Chengdu Esimtech Petroleum Equipment Simulation Technology Co., Ltd.

ESIM-FTD1

Top Drive Simulation Training System

Technical Specification

1. Introduction

Top drive simulation training system is constructed according to advanced training mode and training method, focusing on the cultivation of practical operation ability.

The top drive simulation training system is developed aiming for training the operation of top drive device. It can provide training items of all top drive operation and common accident handling. It can be used for training for driller/ driller assistant, technicians, and drilling team leader. Through training with the system, trainee can master the operation method of top drive and handling skill of common accidents.

The system adopts various mathematical models to simulation the working principle of top drive, reflecting the changing rule of various parameters. Event-driven simulation technology can simulate various operation of the device which make the training closer to reality. Accidents pre-set technology simulating common accidents and device fault, enables instructor to insert the accidents or faults at any time. Trainee then can judge the phenomenon then make correct actions. This improves their skill of judging and handling accidents. Virtual reality technology constructs a perceptual environment; 3D animation synchronic with operation displays the site scene, combining with vivid sound effect. All of those makes up an immersive training environment.

Top drive simulation practice system is composed of a few top drive simulation systems. Each simulation system consists of top drive console, drawworks handle, computer and two touch screens. Top drive console is made according to the top drive produced by Beijing Petroleum Machinery Factory. The controls layout, operation method, parameter display is the same as the real product. Hardware device is constructed by industrial PLC, which ensures the reliability of the system. The system has also the advantage of low input and maintenance cost without security risks.
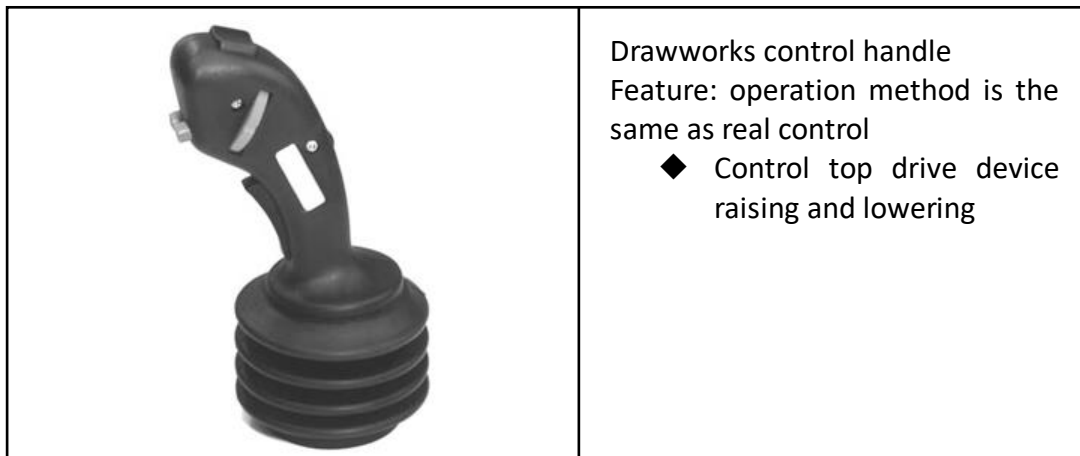
2. System component

2.1 Major hardware

1. Top drive console is made according to the top drive produced by Beijing Petroleum Machinery Factory. Ti can simulate various operation, co-movement relation and control logic of top drive, including IBOP, turret lock, links rotation, links tilting, clamp, operation select (drill, spin, torque), direction select (CW, stop, CCW), etc.

Top drive console
Feature: simulating top drive produced by Beijing Petroleum Machinery Factory
◆ Control top drive device

2. Drawworks control is made according to the model of onsite drawworks control.

<table>
<tr><td></td><td>Drawworks control handle
Feature: operation method is the same as real control
◆ Control top drive device raising and lowering</td></tr>
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2.2 System main software

1. Device principle multi-media software

2. Top drive device control software module

3. Sound effect control software module

4. System diagnostic module

5. Student management and automatic scoring software module

6. Top drive-based 3D scene display software module

2.3 System standard configuration

SN	Name	Technical specification	Unit	Q'ty
1	Top drive console	Simulating top drive produced by Beijing Petroleum Machinery Factory	Set	5
2	Drawwoks control handle		Set	5
3	Computer	CPU: i7; memory: 16G; SSD240G; discrete graphic card	Unit	10
4	Monitor	23 inch	Unit	10
5	Displaying system	4K 80 inch LCD screen	Set	1
6	Esimtech top drive simulator master control software	Esimtech	Set	5
7	Esimtech top drive simulator graphic software	Esimtech	Set	5
8	Student table and chair	Special for education	Set	5

3. System function

3.1 Functions and features

1. The system provides conventional top drive operation, such as tripping in and out, drilling, IBOP, top drive making up, top drive breaking out, links rotation, etc. It can also provide training for

common accidents, such as top drive reaming, back reaming, etc.

2. Top drive simulation system simulates the real equipment so that trainees can operate the system without any sequence restriction. The system can reflect any operations students made, just as operating a real top drive.

3. The system has the function of displaying top drive working principle by 3D animation. So that students can understand the working principle and maintenance of top drive better. The animation provides the display of working principle of IBOP, turret, links tilt and rotation structure.

4. The system can simulate accidents and faults. Instructor can insert various top drive faults at any time during exercise. Students can judge the faults through various phenomenon (such as different states of alarms).

5. The system adopts the working mode of step by step. Though it is a non-sequence system before each student, we provide the working mode of step by step. Under this mode, instructor can give lecture of top drive operation procedure step by step to enable students to master top drive operation quickly, such as working process of making up drill stand.

6. The system can simulate various noises of well site. The noise is synchronic with students' operation, working condition and graphic display.

7. The system has automatic scoring function. It can give scores to students' operation, and gives point deduction reason, which makes training fair and just.

8. The system has complete students' information management function.

3.2 Training items

3.2.1 3D animation display of top drive working principle
1) Turret lock
2) IBOP
3) Top drive rotation
4) Links tilting

3.2.2 Step-by-Step working mode
1) Tripping in
2) Tripping out
3) Top drive making up
4) Top drive breaking out
5) Normal drilling

3.2.3 Non-sequence operation mode
1) Tripping in and out
2) Drilling

3.2.4 Problem treatment
1) Resistance during trip-out
2) Resistance during trip-in

4. Technical parameters and working environment

4.1 Technical parameters
1. Power: 220V/50Hz AC
2. Power consumption: <3000W

3. Resolution: 1920*1080

4.2 Working environment

1. Area: ≥10*8.5m

2. Working temperature: 0℃～30℃

3. Relative humidity: <90%

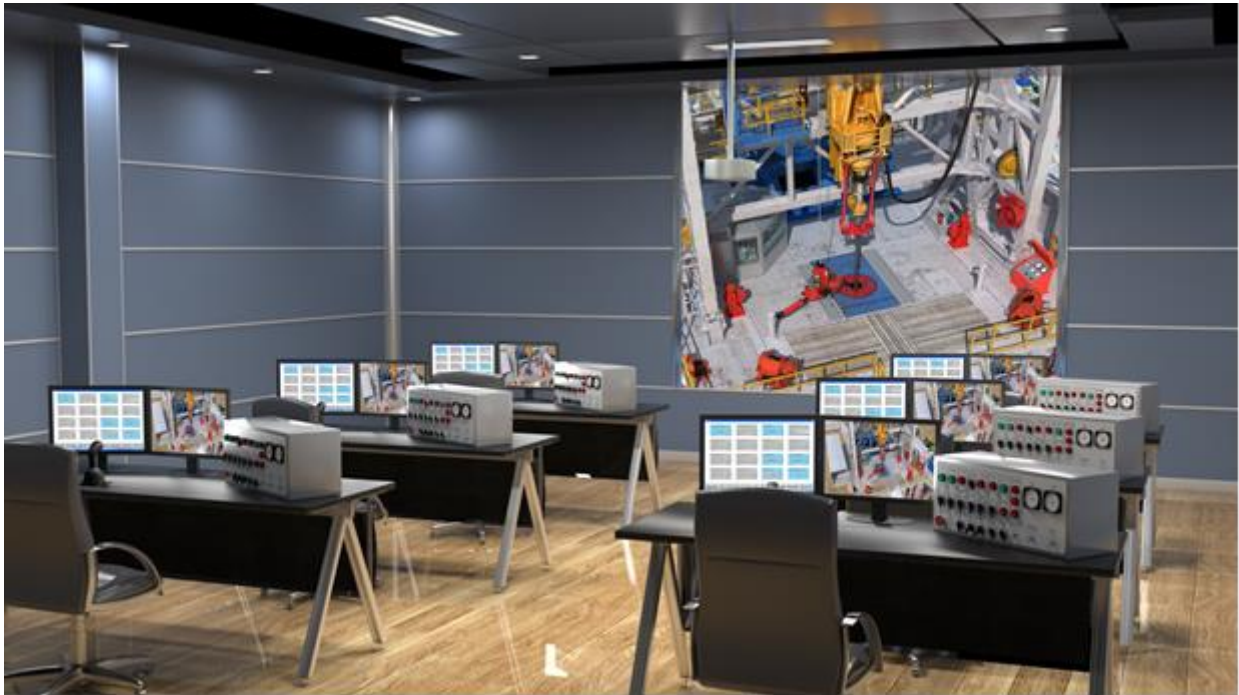## 5. System whole layout and program interfaces

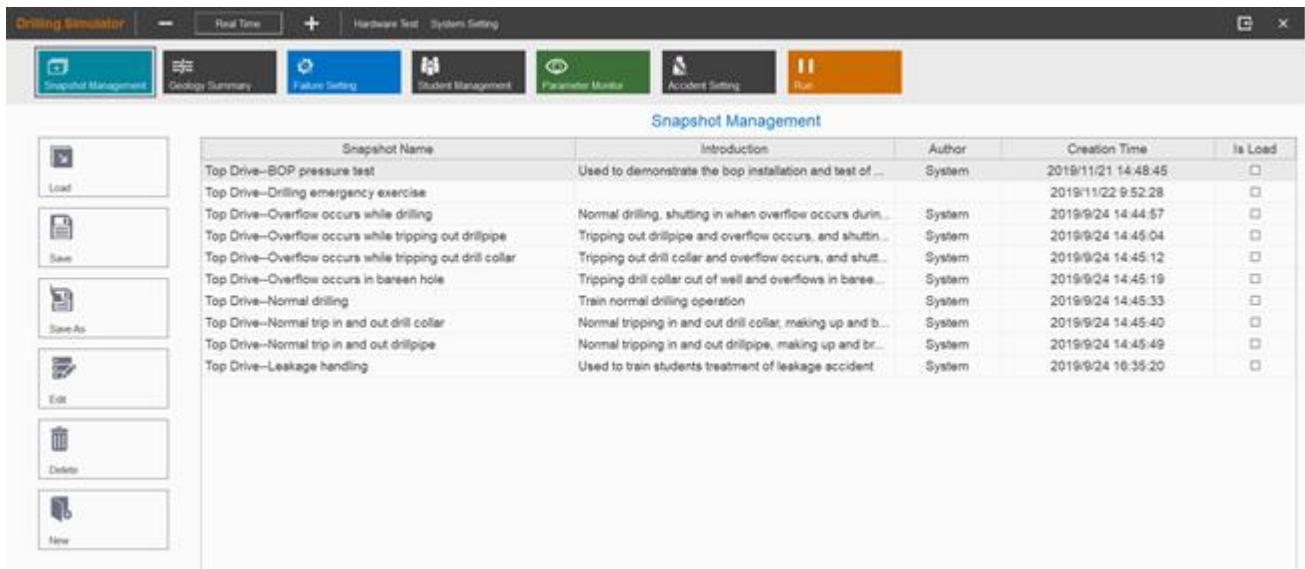Figure 1 Top drive simulation lab effect picture
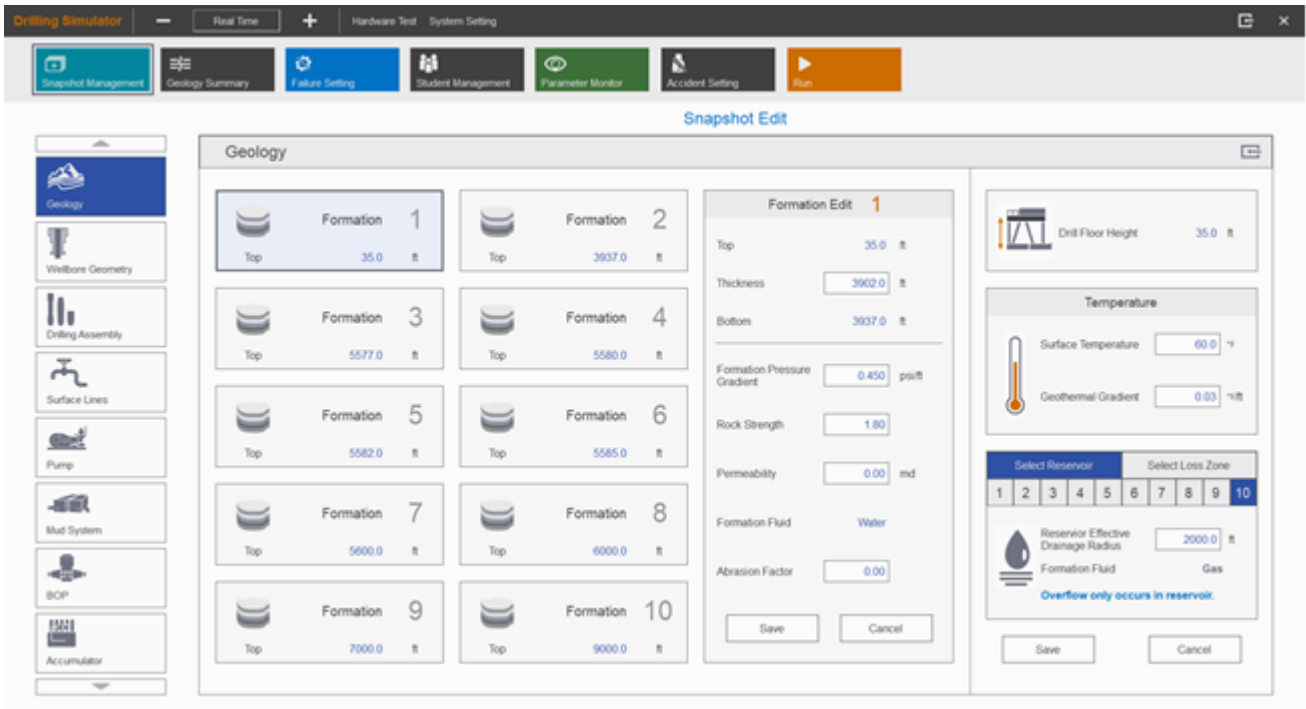

Figure2 Master control software interface

Figure 3 Software running interface

Figure 4 Graphic program running interface

Figure 5 Working principle display