Advancements in Classroom Simulators

SCS PowerPlantSim 2013

Joel Dixon / Mark Terry
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Full Scope Power Plant Training Simulators are large capital investments that are not always utilized to their fullest extent. With today’s advancements in computer technologies, classroom simulators can provide a valuable tool with extended capabilities that in the past were not considered practical or even conceived. This presentation provides a look into some of the innovative advancements that can be brought to the classroom simulator environment, especially for the instructor, which allows for greater flexibility and utilization of full scale simulators; thus increasing the value of the original simulator investment.
O&M Solutions Power Training Institute (OMSPTRI) had a need to provide power plant training for the education of power plant operators using Generic Fossil and Generic Combined Cycle Simulators in a Classroom environment.

O&M Solutions Power Training Institute is a CEA (Central Electricity Authority) recognized category I institute to impart training.

http://omstraining.net
Requirements

- Three generic power plant types
  - SuperCritical
  - Drum Boiler
  - Combined Cycle

- Simulators must be easily portable and installed on multiple workstations

- Simulators must be in SI units

- Simulators must have the minimum number of DCS Systems to allow a student control the plant with the least number of Human Machine Interface systems
• Generic Super Critical Fossil Simulator, 700 MW, Once-through Boiler
Generic Simulators

- Generic Subcritical Fossil Simulator, 375 MW, Drum Boiler
Generic Simulators

- Generic Combined Cycle Simulator, 635 MW, 2 on 1 configuration
Emulated Distributed Control System (DCS):

- Each simulator is controlled by one or two generic emulated DCS
- Virtual or stimulated distributed control systems are not practical due to cost and portability
OMSPTRI Hardware/Software

- **Hardware:**
  - Desktop Simulators - Workstation Class Computers with four 22” LCDs
  - Instructor Station - Workstation Class Computer with eight 22” LCDs
  - Tablet PC (Windows 7 based)
  - Network Switch and Wireless Access Point
  - Color LaserJet Printer

- **Software:**
  - Windows 7
  - 3KEYMASTER Simulator Environment and Loads
  - Remote Desktop Software (3rd Party)
OMSPTRI Block Diagram

OMSPTRI 3KEYMASTER Classroom Desktop Simulators

DeskTop Simulator 01
DeskTop Simulator 02
DeskTop Simulator 03
DeskTop Simulator 04
DeskTop Simulator 05

DeskTop Simulator 06
DeskTop Simulator 07
DeskTop Simulator 08
DeskTop Simulator 09
DeskTop Simulator 10

Network Switch

Wireless Access Point

Remote Instructor Station (Tablet PC, Wireless)

Color LaserJet

Instructor Station

IS Control

Student Monitoring LCDs

Student Monitoring LCDs allow viewing up to four Displays of any DeskTop Simulator:

- No Special Hardware (extra quad video card)
- Uses Remote Desktop Software
- Can View or Control Student Simulator
- View all LCDs from one DeskTop, or any combination of LCDs from any DeskTops
Configuration/Execution Options

Desktop simulators can be used and controlled in two different methods:

1) Standalone Simulator
   ▪ Any Desktop Simulator can independently execute any of the simulation loads

2) Server/Client Mode – Desktop connects to another workstation running the 3KEYMASTER server/load:
   ▪ Another Desktop Simulator, or
   ▪ The Instructor Station
Standalone Simulator

- Running in Standalone mode starts the 3KEYMASTER server application on the workstation, as well as initiating the 3KEYMASTER client.
- The server and client are self-contained on the workstation and run independently of any other computers.
- The Instructor Station (IS) computer can connect to the workstation to monitor and control the simulation using any of the many Instructor Station features.
Client/Server Mode Simulator

- Starting up as a 3KEYMASTER client does not start the 3KEYMASTER server, but instead, initiates a network connection to the workstation that is acting as the 3KEYMASTER server (the workstation that it connects to is dictated by a pre-defined configuration file).

- Allows all of the users to interact with the same simulation.
Instructor Observation

- From the Instructor Station, the instructor can connect to 4 different Desktop Simulators.
- The instructor can observe more than one display on the student’s desktop simulator.
Instructor Control

- From the Instructor Station, the instructor can connect and take remote control of a Desktop Simulator’s display or displays
  - While connected, the instructor can remotely show the student what to do or what they might have done incorrectly
- The instructor can initiate Instructor Station sessions for up to 4 Students
  - Each IS instance’s status bar provides indication (with color & text) of the Desktop Simulator it is connected to
Remote Control Instructor Station

- Using a wireless, Windows-based Tablet PC, such as the HP Slate 2 platform, the instructor can roam the classroom and control the simulator load and training session from the Tablet PC
- More advantageous than previous handheld Pocket PC’s, which had limited Instructor Station capabilities
- The Tablet PC Instructor Station platform is similar to that of a Desktop or Laptop, but more portable
- Instructor has access to all simulation displays, P&IDs, etc. from where he/she can initiate simulation events
Startup/Shutdown Procedures

• Startup and Shutdown procedures developed for operation
• Used to train students on proper procedure

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• Separate procedures made for each generic plant and different startup methods

### 4.23 Loading Mill AB

<table>
<thead>
<tr>
<th>Action Step</th>
<th>Simulator Action/Checks</th>
<th>Action Screen/Place</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start loading Mill AB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Increase “MILL E/F LOAD DEMAND SP” by steps +5% to 80%</td>
<td>FG02 Mills/MILL AB</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Verify that “Turbine Load Margin” is acceptable.</td>
<td>FG10 CH 1 Turbine</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Increase drum pressure when load raises with slop approximately ONE kg/cm² drum press = TWO MW.</td>
<td>FG16 U COORD</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Adjust “BOILER PRESSURE SP” to the desired value.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
At Least two Instances of 3KEYMASTER executing on each Server

Connect via VPN, or 3rd Party Product, such as LogMeIn.
Intelligent Tutoring System (ITS)

Web Based Graphical Interface

Trending System

Alarming System

3KEYSTUDENT Web Interface
Example of a Simple Lesson

Lesson on Electric motors
THANK YOU!

Western Services Corporation
7196 Crestwood Blvd, Suite 300
Frederick, MD 21703
www.ws-corp.com

Joel Dixon  301-644-2500, ext. 2649
dixonj@ws-corp.com

Mark I. Terry  301-644-2518
terrym@ws-corp.com