Nuclear Automation

AP1000® Classroom Simulators

Background

Simulators provide a realistic plant environment that operators can use to train employees on how to safely run a nuclear power plant. The simulator supports training on normal plant operations as well as plausible plant malfunctions. Full-scope simulators are an exact replica of the plant's main control room and provide the highest-fidelity simulation required for operator licensing. Because of their high fidelity, simulators provide many benefits to other staff members throughout the utility, but rigorous training schedules for operators often prevent other staff members from using the simulators. Building and maintaining multiple full-scope simulators is not economically feasible.

The AP1000® classroom simulators were designed as a cost-effective way to provide individual, high-fidelity simulators with an interactive classroom environment to staff members throughout the company. They provide individual learning opportunities and an engineering platform for preparing and testing future plant modifications to help with project/outage planning for improved performance and risk mitigation.

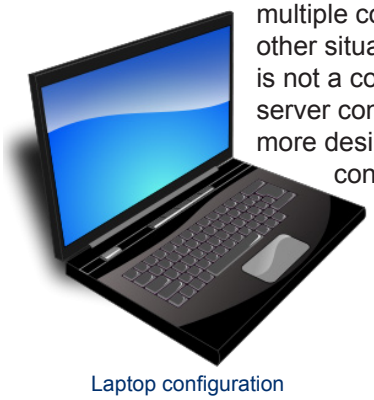
Description

The **AP1000** classroom simulators reuse the software from the full-scope simulator whenever possible to provide a high-fidelity simulator while keeping costs down. They are built using the same JADE™ instructor station, plant models and control system models, as the full-scope simulator. This allows initial conditions, automated plant procedures, and malfunctions to be shared between the full-scope and classroom simulators. It also reduces the amount of separate software to be maintained, and minimizes new learning when staff switch from the full-scope to the classroom simulator.

The classroom simulators also support the same safety flat-panel displays, alarm presentation system, nuclear applications, and computerized procedures as the full-scope simulator.

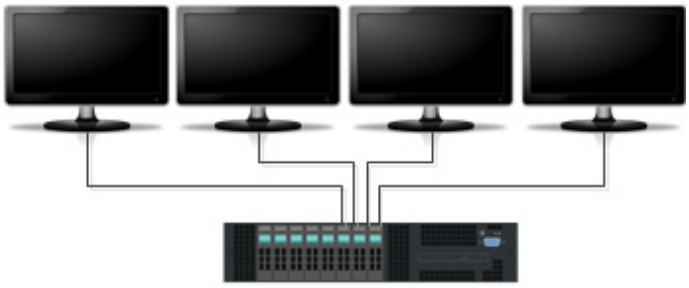
The **AP1000** classroom simulators reduce training costs by eliminating hardware and replacing it with software solutions. The Ovation™ distributed control system becomes fully simulated using the Westinghouse Standard Simulator Classroom Suite product. This product mimics the Ovation human-machine interface applications, including the graphics, signal diagrams, trends, and alarms. These custom applications provide a similar look as the plant system, but are not identical and some noncritical features may not be supported. The full-scope simulator also has several hardware panels with switches to trip the reactor, initiate system-level safety actuations, and provide various other plant functions. These hardware panels are all removed and are simulated using the panel mimics in the JADE™ instructor station.

The **AP1000** classroom simulators were implemented as a scalable design and come in three different configurations. In the simplest design, the classroom simulators can run on a single laptop. This allows users to work at their desks, have the flexibly to take the simulators home with them, or easily share them with multiple colleagues. In other situations, portability is not a concern and a server configuration is more desirable. The server configuration can be set up with four monitors so that several plant systems can be monitored simultaneously. These systems also can be locked in a server room and are more secure for exam development.



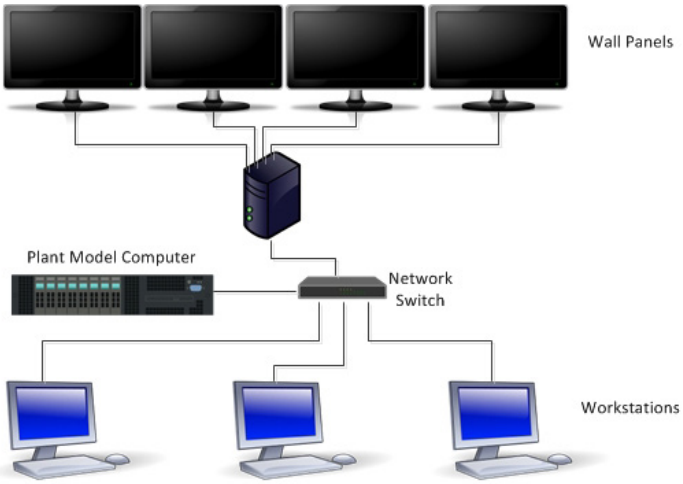
Laptop configuration

Westinghouse



Server configuration

The classroom simulators also can be set up on a network to allow multiple users to share the same simulation. This configuration can provide a more realistic control room environment with multiple large-wall panel displays and individual workstation consoles for each operator.



Network configuration

Benefits

The simulator software was specifically designed to provide high-fidelity simulation for classroom operator training. With the classroom simulators, the instructor can run the simulator in a classroom environment and demonstrate the plant operations with dynamic responses, including alarms. This better prepares students for what they are going to see on the full-scope simulator.

Everyone learns at a different rate. The low cost of classroom simulators enables employers to provide every student with his or her own personal simulator, which allows students to rerun training scenarios as many times as needed and to focus on their own problem areas.

Students can access the entire list of simulator malfunctions to prepare themselves for whatever they might see during an exam.

Classroom simulators can provide many additional benefits:

- Procedure writers can test procedural updates using the plant controls.
- Instrumentation and control (I&C) engineers can test new tuning constants in a variety of plant conditions before actually using them.
- Training instructors can create new lesson plans and exams without tying up valuable time on the full-scope simulator.
- I&C technicians can train on the control system with dynamic responses.
- Simulator engineering staff can debug simulator problems without having to use the full-scope simulator.
- Burden on the full-scope simulator is reduced, allowing more time for simulator maintenance.

Another useful feature of the classroom simulator is that it can run multiple simulator loads on the same computer. This is especially useful before refueling outages or other major plant modifications. This feature allows the training group to perform Licensed Operator Continuing Training or Initial Licensed Operator Training based on the current plant design in the morning, and then train on post-refueling modifications and a new core in the afternoon, by simply changing simulator loads.

Experience

Westinghouse has successfully delivered classroom simulators to eight different sites on a variety of simulation model platforms.

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