Simulator training of Marine Engineers

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Abstract: Training of Marine Engineers is impossible without simulator practice using computer simulators. Modern computer simulators are intended primarily for solving operational problems such as preparation and starting up of all systems including apparatuses and machines for ship power and refrigeration plants. This also includes stopping and changing modes of operation of these plants. The efficient operation of marine equipment is impossible without knowledge of the structure and principles of operation of technical facilities. Our computer simulator is designed to study the structure and principle of operation of machines and apparatuses for marine refrigeration plants, and also for solving operational problems. Features of this computer simulator are:
- the ability to run the simulator program on three operating systems (WinXP, WinVista and Win7),
- the teacher can independently add, change, delete, renew the simulator's schemes, change basic units of the scheme and construct an apparatus by using the integrated multi-graphic system for automatic analysis of vector objects on the working plane. This system is protected by a certificate of registration program for PC in the Federal patent office for intellectual property of the Russian Federation;
- the ability to add materials into schemes saved in the simulator program;
- multilevel control system for knowledge, - this simulator program can be used not only on a PC, but also on large-format interactive displays. Cadets assemble the scheme using suggested elements in real time. If they assemble the scheme correctly, they must indicate the movement direction of refrigerant and sequence of actions for solving standard operational problems. Also, the simulator program provides testing during these stages. Another important feature of this simulator is the ability to adapt it to other ship's equipment such as engine and boiler room, if there is sufficient information (specifications, diagrams, etc.) on a particular machine. The use of our computer simulator will allow us to improve the quality of training of Marine Engineers for operation of ship power and refrigeration plants.

Keywords: computer simulator, marine engineers, training, integrated multi-graphic system, control system, training quality, self education.
Training of Marine Engineers is impossible without computer simulator practice. Simulator training is required for theoretical knowledge and operational skills and should be done before trainees leave for manufacturing practice on board.

Modern computer simulators are intended primarily for solving operational problems such as preparation and starting up of all systems including apparatuses and machines for ship power and refrigeration plants. This also includes stopping and changing modes of operation of these plants. 3D computer simulators that look like a computer game where trainee makes all necessary operations are developed very actively today.

The efficient operation of marine equipment is impossible without knowledge of the structure and principles of operation of technical facilities. This is particularly evident in abnormal and emergency situations, when an engineer makes wrong decisions that are most often due to lack of knowledge about the processes occurring in the apparatus.

The optimal way to test and consolidate knowledge of design and operating principles of technical devices is to use a stand made from real hardware. Due to the rather rapid equipment development, constant updating of stands is quite difficult. One of the variants for consolidation of theoretical knowledge about the design of an apparatus and its operation is the use of computer simulators.

Our computer simulator is designed to study the structure and principles of operation of machines and apparatuses for marine refrigeration plants, and also for solving operational problems, [2].

According to the state educational standards, the use of interactive media and information technology is actively encouraged, [1].

Features of this computer simulator are:

- the ability to run the simulator program on three operating systems (WinXP, WinVista and Win7)
- the teacher can independently add, change, delete, renew the simulator’s schemes, change basic units of the scheme and construct an apparatus by using the integrated multi-graphic system for automatic analysis of vector objects on the working plane. This system is protected by a certificate of registration program for PC in the Federal patent office for intellectual property of the Russian Federation;
- the ability to add materials into schemes saved in the simulator program;
- multilevel control system for knowledge
- this simulator program can be used not only on a PC, but also on large-format interactive displays.

Cadets assemble the scheme using suggested elements in real time. If they assemble the scheme correctly, they must indicate the movement direction of refrigerant and sequence of actions for solving standard operational problems. Also, the simulator program provides testing during these stages.

Training and testing (control) modes are provided in the proposed computer simulator. In the first mode, the program immediately shows the wrong actions of the trainee. Hereby we consider work with simulator on the example of an ammonia brine horizontal shell and tube evaporator.

In the training mode, the program performs elementwise checking of the placing of details of the apparatus, the sequence of assembling and indicates correctness of the placing of details (green - right / red - a mistake), Fig. 1.
The second step is an intermediate control, in which the trainee must complete full assembly of the apparatus. After complete assembly, the check takes place. In the case of a mistake, it is necessary to correct incorrectly placed items in the unit, Fig. 2.

The third step is a test of knowledge of the processes occurring in the evaporator by pointing to the direction of movement of refrigerant and brine (intermediate coolant) on the assembled scheme. After the cadet completes this task, the program performs the check, Fig. 3.
Figure 3. Check the directions of movement of working substances in a horizontal shell and tube evaporator

The fourth and final step is to solve operational problems. This phase includes tasks such as preparing for starting up and starting up of the brine system and evaporator, the output of oil and stopping the evaporator. To perform this step a separate scheme is displayed that includes the evaporator, all piping with shutoff and control valves and the brine system (Fig. 4). Solving problems is done by opening / closing of valves by double-clicking the left button of the mouse.
The important feature of this simulator is the ability to adapt it to the other ship equipment, such as engine and boiler room, if there is sufficient information (specifications, diagrams, etc.) on a particular machine.

Further work is planned towards the completion of the program schemes of other units of a ship’s refrigeration plant and the creation of additional functions such as forecasting of operation modes under different external conditions. The implementation of this function will be developed on the basis of mathematical models of components and devices of a ship refrigeration plant which take into account the influence of external and internal factors on the operation of the plant. These mathematical models were developed by the “Refrigeration, air conditioning and cryogenics” department of the Baltic Fishing Fleet State Academy. Forecasting of operation modes means evaluation of one or more factors of the working parameters of the studied apparatus.

It is also planned to use photos of parts and components of devices instead of the schemes for better visibility.

The use of our computer simulator will allow us to improve the quality of training of Marine Engineers for operation of ship power and refrigeration plants and to minimize the impact of the “human” and “personal” factors on the safety of the ship’s equipment.
References
