SIMULATION TECHNOLOGY IN THE EDUCATIONAL PROCESS

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ABSTRACT

The development of the maritime transportation and its connected activities imposed the necessity of having more trained people involved in operation, able to act in very various situations based on a considerable volume of knowledge. To achieve these standards, the training process, especially for operation, safety and security activities, must be highly professional and in concordance with the international requirements in the field. This professional training involves the use of the latest developed techniques. The new technologies used today for the purpose of training in the maritime academic field are various, as simulators, dedicated computerized programs and all types of virtual learning. The paper reveals the simulator training process that Constanta Maritime University introduced in its education system, with good performances on the students' competencies and abilities. The focus is on the presentation of the course developed by the Electromechanical Faculty, through this process contributing to the skills development and also testing of the students, future marine officers. The paper, a case study on the simulator training process, is based on a rigorous and detailed presentation and analysis of the simulation and through the information presented offers an exhaustive and clear image of this new technology.

Keywords: *Simulation technology, simulator training process, education, computerized programs*

1. INTRODUCTION

The activities onboard ships are based on competences and skills. In order to have competent people, you must create them. This is the role of the maritime training system, to create competent persons for the maritime field.

Today, Constanta Maritime University (CMU) is the principal academic training institution in Romania. This position was acquired through a continuous effort to offer to the future deck and engine officers the best training and knowledge in the interest field. In this respect, changes were made, starting with re-evaluation of curricula, which was brought closer to the present requirements of the STCW Convention and shipping industry, succeeded by the improvements of teaching methods, usage of the high technology and newest simulators in this process, and last but not least, improvement and increase of the level of the trainers and teachers according to the latest technological development in this area of training. This was not an easy process, the beginning and first stages were complicated, partially due to the reduced knowledge on the new technologies and the best way to perform the best training in order to reach the proposed results. These difficulties were not finished once the familiarization started, they continued after this stage because the technological changes soon brought new products and also new procedures.

2. SIMULATION USAGE IN EDUCATION

Today, education is inseparable from the modern and new navigation technologies as teaching marine simulator, modelling, on-line teaching or web based applications. Introducing these new technologies in the educational process must ensure that these new training methods improve the technical knowledge of the student, an important guarantee for the professional skills of the future marine officer. Thus, the modern navigation educational technologies have had a higher demand in the last years and registered a large development and dispersion. The necessary changes in educational structure came without directives from leaders from academia, industry and government laboratories. There is a direct and natural result of the technological changes from our reality and also of the new requirements that have emerged in the educational and labor market.

Simulation represents a tool to generate "artificial experience" that would significantly improve professional judgment in the consultation process, especially with respect to human performance. The simulation exercises allow the learner to experiment with multiple approaches to solve a problem. Learners try different solutions in a safe environment and receive feedback.

The use of simulation in providing solutions to the problems of risk and crisis management and the optimal use of crew resources has a long history in maritime training. Many types of simulator: engine, bridge and cargo control room have tended to emphasize a physically realistic environment in which the exercises occur.

The scope and amount of simulator based training in crisis management needs to increase. Areas such as initial actions to spill oil and a distress incident need to be incorporated into simulation training programs. Simulation based training in the corporate emergency procedures also needs to be conducted to ensure that mariners are not reaching for the emergency manuals to find out what to do once an incident happens.

The development of the computer technology had a dramatic influence on simulators; also the new and developed needs of training from the education area stimulated the research in this field. The education system had to follow and implement the simulation

technology, the computerized knowledge being part of the educational processes, or even the essence of these, in some cases. As beginners, these simulation programs did not have a very expressive way for revealing the results and the procedures for obtaining results were difficult. During times these programs were improved and became indispensable for training courses processes. The next step in the technological development of the education training process was marked by the advanced computerized programs, most complex, with a more real presentation of processes and operations, the simulators.

In some parts of the world, simulators have been developed which have very high levels of physical fidelity, for example, multi-storey engine room mock-up and bridge simulators including features such as 360 degrees day/night views, pitch and roll, and full vibration and noise effects.

The simulators used in the maritime officers training is a compulsory request of the STCW Convention and Code in order to assure an increased safety of maritime activities.

3. ENGINE ROOM SIMULATOR AT CMU

Over the last years simulator training has proved to be an effective training method when training engineers, especially where an error of judgment can endanger life, environments and property. A dynamic real-time computerized simulator can, when it comes to certain situations, compress years of experience, into a few weeks and give competence to handle these situations and knowledge of the dynamic and interactive processes typical for a real engine room.

The simulators improve efficiency and give to the students, future engineers, the necessary experience and confidence in their job-situation.

Starting with 2002, CMU installed and put in operation three Kongsberg Norcontrol simulators: GMDSS and SAR simulator, Engine Room Simulator and Navigation simulator. CMU installed these simulators to organize practical training for its students and graduates, for ship and shore users, as well as for system service engineering training. Simulators, used for the practical training, proved to be the perfect solution to create appropriate conditions similar to the real situation on board ship - regarding operating ships, maritime equipments, practicing procedures established by the International Safety and Rescue Rules.

CMU has a KONGSBERG NORCONTROL ERS-MC 90-III Engine Room Simulator (ERS) that simulates a very large crude carrier with a MAN B&W slow speed turbo charged diesel engine as propulsion unit modelled with fixed and controllable propeller. The control room operator station and panels and bridge and steering panels are included. The ERS consists of:

- Kongsberg slot machine simulator - Simulation NORCONTROL MAN B & W Neptune 5L90MC - VLCC version V (the newest version, upgraded in July 2010) Class A Full;

Figure 1 Main switch board

Figure 2 Control room

- BigView based on four monitors (diagonal of 65") that allow for viewing and operation of all systems in the engine room department;

Figure 3 BigView

- Desktop simulation system consists of an instructor station and 8 workstations with the following available models:
  - MAN B&W 5L90MC - - VLCCL11-V;
  - Sulzer 12RTA84 - Container L11 ;
  - GE LM2500 30 - Gas Turbine ;
  - SP11 (Steam Propulsion) - LNG - Dual Fuel ;
  - Pielstick 10PC4 M22 - Ferry Boat.

The simulator is Full Mission Class A and is IMO, STCW and DNV certified.

Figure 4 Desktop simulation

4. SIMULATOR TRAINING PROCESS

Constanta Maritime University, through the Naval Electromechanical Faculty, uses the engine room simulator for research and training purposes. A complex course based on the simulator was defined that emphasizes the training process for our students. Such concept course is not easy and requires careful planning and management to be successful.

Forwards, the focus of the paper, a case study on the engine room simulator, is on the rigorous presentation of the Engine Team and Resource Management course developed by CMU.

The aim of the course is to familiarize the students with the operation of systems from engine room under varying conditions and to practice working procedures applicable to the board in terms of teamwork. This course is essentially a practical one and includes a series of exercises structured around the operation of a naval installation and built in collaboration with an engine simulator. The exercises are supervised by an instructor and a technician who, initially, allow the students to familiarize themselves with the tools and controls found in a commercial vessel's engine room. The student will have the ability to know the installations and auxiliary aggregates of an engine room under normal operating conditions and in such emergency. The exercises increase in difficulty throughout the course, the student is familiar with the procedures used for propulsion and auxiliary power facilities, with settings in normal operating conditions and monitoring tool during the watch.

Each exercise is preceded by a briefing session and followed by a discussion group - debriefing, where the actions and decisions taken by the student are examined.

During these exercises, each student assumes different roles in the engine watch keeping team and will be able to perform all operations during the watch keeping, covering all functions of an engineering hierarchy.

The aim of this course is to provide knowledge and skills required to operate, supervise and monitor the safety of the ship facilities in accordance with the provisions of Section A-III / 1, A-III / 2, A-VIII / 2 and B-VIII / 2 STCW95 the Code. The present course refers to many requested functions for a proper training of the students, who receive:

- Familiarization with the use of instrumentation and monitoring systems used in the engine department;
- Awareness of the need for better planning, use of checklists and programming times for specific procedures;
- Proper understanding of the supervisory procedures;
- Understanding the way in which the motor units are interdependent
- Gaining operational experience in identifying problems and solving them;
- Ability to make decisions;
- Organization of an engineering team;
- Knowledge of the individual role of each member in the context of teamwork;
- Performing specific tasks according to specific situations

The briefing and debriefing sessions and practical exercises on the simulator run under the guidance and supervision of two instructors and a technician certified by the company Kongsberg, the provider of the engine room simulator.

The course inside the education project based on the engine room simulator combines three different but interdependent content levels:

- Theory Modules
- Simulator Exercises
- Analyzing the results of the exercises

The course covers more than the requirements of the IMO-model courses. It starts with a "pre-test" to ensure that all participants are starting with at least a comparable level of knowledge.

1. Theory module (printed and Macromedia format). The theory is presented in a comprehensive way. Moreover, exercise and evaluation forms are shown from the beginning to the trainees. This module includes also Step by step demonstrator (simulator interactive demonstration, ViewletBuilder format) that represents all the steps the students or the trainees need to follow when a specific process is running on the simulator.

2. Simulator exercises (with e-Coach and evaluation editors), conducting practical exercises based on the engine room simulator KONGSBERG – NORCONTROL SIMULATION Neptune MAN B&W 5L90MC – VLCC. When creating simulator exercises, a certain procedure is followed. It has many steps, starting with the need for analysis for the exercise to be carried out. The exercises are very complex and various; the student works together with the instructor, the student works alone supervised by the instructor, the student works together with other 2 colleagues and forms a watch keeping team, developing the team work skills.

3. Analyzing the results of the exercises. Each exercise has an evaluation form consisting of various evaluation criteria. All these evaluations became evaluation actions inside the simulator. After the student/trainee runs a specific simulator exercise, a

database of the student's work is created and the instructors have the students exercise results.

The interactive mode of teaching this course, the proposed exercises and the situations created and the solutions offered of these particular situations make this course to be very attractive to students. The familiarization with the reality on board of a commercial vessel helps considerably in their future work of maritime officers, giving them confidence in their professional skills. Their real interest for attending this course leads us to continue this activity and improve the students' educational offers in the future.

The results obtained from the simulated application conducted us to conclude that this process is more appropriate for training than classical procedures based exclusively on the theoretical elements. The results and the performances obtained during this process are a proof of the improvement of the education system by these technologies and indicate the way to which the education has to be directed: more technological segments combined with the theoretical elements.

5. CONCLUSIONS

Simulation became a key method to achieve progress and performance in the educational area. This paper comes to enrich the information in this field, and could have extended echoes among trainers from education and beyond.

Based on the simulator training, the students can consolidate the theory information through practical exploration, they can try many times current operations they will perform on the ships in the future. Thus, their confidence is higher and the fear of failure is much lower.

The Engine Team and Resource Management Course was approved by the Romanian Naval Authority in 2008 and became mandatory for obtaining the competency certificate for maritime officer, operational level, in 2009. The course is addressed mainly to Constanta Maritime University students in the final year of study. As a result of the interest raised by the simulators, according to the statistics in recent years, the number of our students who passed a simulator training process increased, with good results in their next activity and also with good appreciation received from the shipping companies. Thus, around 50% of our students attended and passed the Engine Team and Resource Management Course during the year 2008-2009, a higher percentage of 90% during the year 2009-2010. From the beginning of this academic year, 2010-2011, 60% from our students from the last year attended this course and this percentage will surely reach the level of 90%, taking into account that this course becomes a compulsory one starting with January 2012, based on the STCW regulations. As a result of attending this course a higher pass rate in the examination for the competency certificate was noticed, but also a more accurate organization on board and an easy and quick resolution of the difficulties encountered there by our students; these results are based on the feedback received from the companies.

Level of skills developed or improved after such training increased in the last years, contributing to an easy access of the Romanian cadets and younger officers to the international maritime work force market. Today, our graduates are accepted as equal competitors along other nationality officers and respected for their knowledge and training level.

The encouraging results obtained by the students give the right to consider that the use of multimedia tools, computer program and web enabled simulation modules must be constantly improved and extended within the educational process. Also, the interactive methods prove to be efficient and have to be developed widely in the future. Distant learning combined with simulators will make a new and flexible training approach possible. Therefore, we can finally consider that e-Learning has a great and positive impact on the maritime education field and moreover learning combined with training will be by far the most effective way to increase skills and competence.

6. REFERENCES

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