SIMULATION FOR TANKERS TOPPING-OFF CARGO LOADING

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ABSTRACT

The main goal of the joint research undertaken in projects SITUMET and OPTIMPORT is focused on maritime distant learning and design of WEB based loading simulator for tanker operation. The strategy adopted for better located maritime education and training (MET) in the work processes on board has three components: distant simulation learning technology – on board and ashore; experiential learning on board and teaching (training) in the classroom or in the simulators. The WEB based Liquid Cargo Handling Simulator is a new generation of training tools, allowing trainees to perform online training when their ship arrives in port.

The main part of the paper is the module developed by the authors regarding Topping Off. That means to fill the tanks to the maximum 98% of the volume, representing the end of loading procedures. The module is reserved for working personnel on board Product Carrier Tankers and is designed to develop the competencies required to execute and monitor the loading/discharging process.

The implementation of Liquid Cargo Handling (LCH) Simulator Software –tankers topping off included– into a learning-management-system (LMS) is a tool to close the gap between theoretical learning and practical experience in maritime education.

Key words: tankers, simulation, e-Learning, training.

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INTRODUCTION

Starting nowadays, the distance learning system is and will be a useful tool especially in those working area where the people will not be able to join daily seminars and laboratories in order to improve their knowledge’s. This is the shipping industry case, where the performances of the personnel involved are in close relation with their learning process. As in other technical work systems, expertise of workers in the maritime domain is declining as a consequence of true apprenticeship experiences. While the complexity of work processes on board have increased due to factors like:

— Automation of ships functions;
— Reduction of crew sizes and
— Multinational crew composition,

The performance of nautical and also technical officers draws on a considerable amount of procedural and conditional knowledge. Nevertheless the listed factors above obstruct both direct and indirect experiential learning, that is, learning by doing and learning by communication as keys to practically acquire the procedural knowledge of “good seamanship” (Chiotoroiu, 2005).

Modern maritime education and training requires the fulfillment of many educational objectives to train and assess students (cadets and junior engineers) and officers of the watch at operational and management level in accordance with the provisions and requirements of STCW 95 and specific IMO courses.

There are certain cases where the only solution to fulfill these demands is the maritime simulators training, like navigation deck management, engine room management and training for familiarization with different kind of ships. In this last category are included petroleum and derivates products carriers, gas carriers and chemical carriers.

The maritime simulators represents in fact a virtual copy of the real ships, including details for on board operations, like load/discharge operations, normal or abnormal functions of different installations.

Consequently, starting with 2003, several advanced simulators have been acquired at the Constantza Maritime University (CMU). As a result, CMU owned a simulation complex comprises of 3 state of the art simulators covering Full Mission Navigation, Global Maritime Distress and Safety System (GMDSS) and Engine Room Simulators (Chiotoroiu, 2005). Moreover, CMU has recently joint an EU project for distant simulation and tutorial systems on board. This will grant CMU a license to use the 4th web-enabled simulator for Liquid Cargo Handling.

For the implementation of this distance learning concept on board ships, EU funds this program for setting up and development of e-Learning modules addressed to the seamen’s, packages which allowed training and assessment on board via maritime communication system.
WEB SIMULATION LEARNING TECHNOLOGY

The distance learning system became one of the principal ways of studying for many students worldwide. Many Universities and Training Centers have already developed their own e-Learning platforms to help trainees having the opportunity to increase their study level or to renew the knowledge's acquired in the school years.

In the same time, there is a great push ahead for advanced distant learning. New development in simulation using Internet has contributed to make the MET systems more flexible. Standards like Sharable Content Object Reference Model (SCORM) or High Level Architecture (HLA) have been developed in support for Advanced Distributed Learning (ADL).

Our goal is to support and optimize experiential learning in tanker operations by means of web-based simulation. This is in fact our present developing stage and represents authors’ participation into the program referring to web enable simulation. The European pilot project SITUMET and the Romanian Ministry of Education project OPTIMPORT, represents a consortium between the manufacturer’s of simulation products (Kongsberg Norway), four Maritime Universities in Europe, included CMU and also seven Tanker shipping companies.

The first step is referring to the tanker related IMO model courses. The main idea is that maritime education and training has to be anchored and (re)located in the work process on board (Schütte, 2003).

Distance, separation, and distribution, not at last, are inherent characteristics of the maritime industry, requiring special solutions for vocational education and training as well as human resources development. From this point of view, e-Learning in general and web-based simulation in particular is a promising way to (re)establish work process oriented MET (Chiotoroiu et all, 2005).

A central effort into this project was the implementation of an internet based infrastructure for distant learning and tutoring that can be used for the distribution of courses tailored (Figure 1) to offer guidance for investigative learning but also theoretical reflection of personally experienced tasks and events (Wand, 2003).

The main tool to close the gap between theoretical learning and practical experience is the implemen-
tation of liquid-cargo-handling-simulator-software into a LMS. Basically, a LMS is software that automates the administration of training events. Thus, LMS ensures easy access to the students, monitoring and tracking for the instructors. Either via internet or a locally-installed learning-management-system, the tool shall ensure that students acquire qualitative mental models and generic intellectual capacities as critical ingredients of proficient work on board. Within this project we are involved, the LMS Scorm® 1.2 compliant is open source software Ilias v. 3.4.4., used in present in different German and French universities (Köln, Bremen, Bordeaux).

Regarding the author ware tool, with respect to LMS compatibility, a multimedia Macromedia® Authorware 7 is used. For simulation exercises, screenshots, interactive demonstrations and courses content, a multimedia software Viewlet-Buider 4 Professional™, created by Qarbon Inc. USA has acquired. This way, the new IMO Model Courses will combine different learning forms: simulation, practical tasks and theory modules. Simulation in particular is utilized as a substitute for concrete experience through job performance, providing opportunities for explorative learning without risk.

E-LEARNING MODULES FOR TANKER OPERATION TRAINING

Distant learning or web based training courses through simulation represent without any doubt a new training method in the maritime field (Barsan, 2002). It is suitable for all seafarers and within a Maritime University like ours, especially for the undergraduate extramural studies or post graduates. The advantages are the asynchronous teaching and distant on-line evaluation and assessment on these new courses based on e-learning. Our intention is to develop in the near future new packages of e-learning (courses, laboratories and tutorials), using this new technology (Chiototoriou and Dinu, 2004). Besides the already mentioned simulators, the software programs available in CMU for the time being are as follows:

— Neptune Liquid Cargo Handling Product Carrier desktop Simulator, Kongsberg Norway (2005)
— Neptune LCH Chemical Carrier desktop Simulator, Kongsberg Norway (2006)
— e-Coach Editor, Kongsberg Norway (2006)
— Macromedia Authorware 7.0, USA (2005).

These e-Learning modules we are creating basically consist of:
— Theory module (in .pdf or Macromedia format) - is presented in a comprehensive way and can be found and access from the LMS (Figure 2).
— Training Objectives and Initial Condition (of the exercise) - according to IMO model courses and standard procedures, any exercise we are creating has a spe-
— Step by step demonstrator (simulator interactive demonstration, in ViewletBuilder format). This represent all steps the students need to follow when a specific process is running on the simulator. The step by step demonstrator Figure 4) is needed because using a simulator, without the supervision of an instructor could be a very difficult task for the trainee. Only help files and tutorials could not be sufficient for explaining the correct operational steps of a real time process. More than that, loading/discharging oil products is a high risk operation, that must be executed in accordance with the specific procedures and monitored all time long. The main role of the online simulator training is to give to the trainee the opportunity to learn the correct procedures and to gain the required skills in order to perform without mistakes the real life job.

— Simulator exercises (e-Coach/Evaluation editors) - until recently, simulator exercises have been monitored by skilled teachers present at all times with students. As a result, Kongsberg Norway has developed a new simulation tool for increasing training efficiency and students throughput, named e-Coach. This feature is very important and specific format which highlights the initial condition of the exercise, the training objectives which has to be fulfilled and final instructions for the trainee before start up the exercise (Figure 3). We have to underline that the online tutorial and training objectives are design similar with the Computer Based Training (CBT) software, because they have to replace the physical presence of the teacher.
mainly compulsory in an online training system, because is the only way to replace the standard debriefing session after a simulation exercise. Through this software, instructor have to be no longer present all the time, allowing for “self-study” to be accomplished by students running e-Coach exercises with assessment features (Figure 5). Using of the e-Coach is not very easy task, because the instructor that have to prepare the scenario and to create the evaluation form, must identify the main events of the simulation and the moments where the trainee could have some difficulties in finding the correct actions.

The e-Coach editor consists of two editors: the Trigger Editor and the Message Editor. The first is used to monitor certain variables to trigger the appropriate message. The second one is used for editing text messages boxes, based and linked to the triggers. The e-Coach messages pop up on the student screens and are categorised as follows:

— Information - which can be general information, hints and tips, positive feedback etc.

— Warning - giving the student a warning when he/she is moving towards situations which may lead to malfunctions or shutdown of equipment.

— Errors - tells the student that he/she has carried out an incorrect action that will cause a critical situation and that the simulation will be terminated.

Simulator exercises on-line assessment - when creating simulators exercises, specific procedure discussed and approved within the partnership shall be followed. It has 22 steps, starting with the need analysis for the exercise to be carried out and finishing with implementing in the LMS after successful testing and improvement the package. Each exercise has an evaluation form consisting of various evaluation...
criteria (Figure 6). We think that from the point of view of the instructor preparing the web based simulation scenarios, the most difficult task is to established the evaluation criteria and to define the actions that must be evaluated. The evaluations sheet that will be displayed to the trainee at the end of the simulation scenario must contained a sufficient level of details in order to give to the trainee a full understandable picture of his behavior during the exercise.

The score is less important than the explanations of the mistakes and errors done, taking into account that practically, the debriefing is replaced only by the scoring sheet.

All these evaluation figures became evaluation actions inside the simulator. After the student/trainee runs a specific e-learning package and therefore a simulator exercise, the LMS monitors and track all his exercise and finally, by accessing a .txt file from Desktop/My Documents/Neptune/Assessment, the instructor have the students exercise results as indicated in Figure 7.

Then, the results can be converted into grades, based on total sum achieved by the student. The evaluation sum is a function of magnitude and duration of the deviation. The deviation occurs when the evaluation criteria value is outside its preset range, as define by its high and low limits (see Figure 7).

Thus, a total sum between 0.00 and 0.15 will means grade 10; 0.16 – 0.20 = grade 9; 0.21 – 0.30 = grade 8; 0.31 – 0.40 = grade 7; 0.41 – 0.50 = grade 6 and 0.51 – 0.60 means grade 5. For any other score exceeding 0.61 the student have to repeat the entire module from the beginning.

![Figure 6. Example of LMS evaluation form for Topping Off one tank.](image)

![Figure 7. Example of exercise results for topping off.](image)
CONCLUSIONS

The encouraging results obtained during testing phase by our students give us the right to consider that the use of multimedia tools, computer programs and web enable simulation modules must be constantly improved and extended to all the subjects and disciplines studied in the CMU in relation with Neptune simulators (Barsan, 2002b). Also, the interactive methods prove to be efficient and have to be developed widely in the future.

The paper has presented the implementation of the new LCH simulators as part of the teaching process. The use of maritime simulators represents an advantage for our University and for the trainees (students or seafarers) in the future because of the:

1. Many simulation scenarios we can create and develop.
2. Total scenario reproducibility.
3. Abnormal situation scenarios created without having any real consequences.
4. On line training/evaluation for students or graduated officers.

These total packages of e-learning programs we are creating will be certificated courses based on e-learning or web-enabled simulation. This will relocate maritime education and training of the work process on board, while developing a network for cooperation between maritime training institutions and shipping companies. In our opinion, the success criteria for this new approach of MET will be the following:

— Reduction of contact hours in maritime training and education (free training and education capacity on shore to serve the growing need for nautical officers in the coming years);
— Harmonization of maritime education in Europe (common standards, methods and a network for knowledge cooperation);
— Employability of entry-level nautical officers;
— Tanker safety (increased human reliability and expert knowledge on board);

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 Romanian maritime education and moreover learning combined with training will be by far the most effective way to increase skills and competence.

Using of WEB based simulators will facilitate also the up-to-date training for officers and other onboard technical staff, bringing maritime training to an upper level of technology and offering more opportunities then the stand alone computer based training (CBT). For the last 10 years, the CBT was the only training system that was found suitable for the seafarers, onboard ships. For ships, real time connection to the Internet via satellite remains an expensive gadget, an during the sea voy-
age time, onboard training must continue to use CBT or other forms of stand alone PC courses.

When ship arrives in ports, seafarers will have the opportunity to access the Internet directly from their cabins, using a low cost (or free) wireless connection provided by the port administration. Constantza Maritime University is undertaking a series of test in Constantza Port, in order to determine practical solutions for providing wireless Internet in the port area. In accordance with these tests, almost in all terminals, wireless connections could be provided using appropriate radio senders and signal could be detected on the laptops located on the alongside board in the upper floors of the ship’s castle.

REFERENCES


