Near-to-live training for container terminal planners: bridging the gap between training and live operation

Proficient use of a terminal operating system (TOS) for planning and equipment control is essential for the efficient and productive operation of container terminals. The degree to which a TOS is used effectively is highly reliant on human operators. The training of these operators is traditionally done through conventional and on-the-job training with a limited structure and a narrow scope. Besides, it heavily relies on the expertise of the on-the-job trainer(s). In this article, we report a systematic training approach we have applied in a number of cases to improve the skills of control room operators in various container terminals. The approach is supported by virtual terminal emulation and allows for accurate measuring of an operator’s performance.

The importance of training

Providing employees with appropriate training is becoming a matter of utmost importance due to the fact that organisational performance is totally dependent upon the performance of the organisation’s personnel. As a consequence, in order to achieve the targeted performance increase, the organisation should invest to improve its employee’s skills through training.

The main objective of training operators with a TOS system is to achieve higher terminal productivity by giving operators hands-on knowledge and experience of using the system. This can be translated into the improvement of decision making and the planning skills of individual operators. However, the main challenge is to train the operators to make the correct decisions in real, high-pressure operations. To achieve this, we propose the use of ‘serious game’ training in a virtual reality arena. Not only is this more effective and efficient than traditional training, it’s also much safer.

Issues with traditional training

Designing a good training system is a challenging task for even the most talented educators. Traditional training usually consists of lectures and book studies, or a combination of the two. Despite its popularity, the traditional method of training cannot show the holistic complexity of a real TOS at work as it focuses only on isolated learning points. Given this static approach, there are obvious limitations in effectively training staff for the complex environment that operators encounter on a daily basis.

Virtual reality and serious games

The type of training we are pioneering consists of simulation models. These models place the trainee in an artificial environment that closely imitates actual working conditions. People's increasing fluency with virtual reality, and the capacity to facilitate the use of modelling tools in virtual environment training, is providing a great opportunity to surpass the disadvantages of traditional on-the-job training processes. With virtual reality training, a trainee can test his skills under realistic conditions, immediately witnessing the consequences of his decisions in real-time. Most importantly, the virtual environment provides a safe playground for testing new strategies that the trainee would not experiment with in real life. Virtual reality training prepares an individual for both complex and high-pressure situations.

Training operators using serious games

During the last decade, much has been published regarding the new-wave training phenomenon serious games. A serious game is a form of virtual training which utilises a simulated virtual environment in which education is given priority over entertainment. There are two things serious games must achieve in training: on the one hand, the training process should aim to transfer the required knowledge and skills to TOS operators in a fun, personalised and subjective way. On the other hand, the training format should be ‘serious’ and didactic in order to avoid the impression that it is just a game with no practical learning application. The two ingredients that are essential to harmonise these two seemingly contradictory methods of pedagogy are a mature virtual reality tool and a properly designed training process.

Virtual reality training tool

In order to run serious game scenarios there is a need to invest in or develop a simulated virtual reality environment. Since the use of serious games is still in its infancy for container terminal logistics, there is only a very limited
number of simulated virtual container terminal tools. We are aware of two of them, one is 'CONTROLS' (Container Terminal Optimised Logistics Simulation) implemented by TBA, and the other is 'ChessCon' from the Institute of Shipping Economics and Logistics. As depicted in Figure 1, the aim of these simulated virtual container terminal tools is to connect to the TOS and let the operators use the TOS as they would use it in real-life situations.

Virtual reality training process
The presence of a good tool is not a guarantee for good training. Our experience has taught us that a well designed training process is more important than the tool itself.

Every training process has three phases: prepare, provide and evaluate. The pre-training phase, or prepare phase, starts when container terminal authorities first request a training session for the TOS operators. This training phase is the most crucial one for the whole process since most of the preparation takes place during this period. The pre-training phase ends when the trainer starts giving the training.

During the training phase, or provide phase, the trainer and the trainees work together in order to achieve the transfer of knowledge and skills according to the training goals that have been set during the previous phase.

The post-training phase, or evaluate phase, focuses on providing assessment. We propose a training process that aims to fill in the three training phases as mentioned above, with a few well-defined training goals central to all phases. A training goal should always be specific. Setting too many training goals is a bad idea because the training might lose its focus. One or two main training goals accompanied with a few secondary goals is considered to be a good combination.

Once the training goals have been finalised, TBA offers training for three kinds of planning roles:

- Vessel planning training for operators responsible for planning the optimal loading and unloading of vessels
- Yard planning training for operators responsible for planning the optimal container locations in a yard
- Equipment dispatching for operators responsible for planning the optimal use of container handling equipment

For each of these roles, different levels of skill and expertise exist that may influence the type of training that is delivered. It is very important to take into account that these two are not necessarily related. We therefore run training on novice, intermediate and advanced levels.

In novice training, the focus is on the correct use of the TOS system and the introduction of a systematic workflow for each role. To familiarise the planners with the different roles, a trainee may perform all three roles in a simple simulation exercise. At intermediate level, the focus is much more on planning with less focus on the TOS itself. By informing trainees of various practices and by placing them in teams, a synergy of teamwork and advanced insight creates an optimal environment for trainees to empirically learn the best port planning practices. On advanced levels, we instruct trainees in the detailed control of modern and complex TOS modules. As with the intermediate stage, different types of simulation exercises are used for different skill levels.

Experience using near-to-live training
We have now carried out a number of training sessions using the near-to-live approach. One of the emulation-supported trainings that has resonated most has been vessel planning training. The main goal of this training is to improve the decision making skills of vessel planners in allocating space to containers on board a vessel. Prior to the arrival of a container ship, the ship's operator sends a so called stowage plan to the container terminal. The stowage plan indicates which containers are to be removed and identifies information about the vessel slots occupied by containers – covering container type, destination and weight. Having this plan available, the TOS operator allocates quay cranes that are going to carry out the load and discharge operations without interfering with each other. Currently, the vessel planning process at most terminals is done manually, so creating such a plan takes multiple hours.

Vessel planning experiment: Manual versus Automation
In order to analyse the efficacy of manual versus automation planning, an experiment was carried out with a trainee group.
consisting of six vessel planners. Each of the six planners was told to plan the same vessel. Three of the vessel planners organised everything manually, while the other three planners were requested to use an automated stowage planning module.

The results of the experiment highlight the average productivity of a crane and the vessel turn time of each individual vessel planner. A key point to state is that the three vessel planners who used an automation solution had no experience at all with the tool. Despite lacking experience, they all performed better using it than their manual counterparts. All planners that used automated stowage planning turned the vessel quicker than the ones that practiced traditional procedures, requiring 25% less time to complete the planning process.

**Summary**

The serious game training using virtual reality tools has been applied for a while in areas such as defence, but it is new to container logistics. Previously, the lack of tools and training approaches rendered it impossible to properly train TOS operators. In contrast, the virtual reality training enables the trainee TOS operator to execute typical day-to-day tasks in a risk-free environment, consistently acquiring feedback on their actions and decisions. Two key elements are required for proper virtual training: a good training tool, and a well planned training program. The training tool together with the training program supports the container terminal logistics community in utilising a new methodology of training; we are anticipating it to be the training practice of the future.

About the authors

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About the organisation

Netherlands-based TBA is a leading international provider of consultancy and software concentrating on marine terminals and intermodal container terminals. Key services are terminal planning using simulation, support of complex software (TOS) implementations and TOS fine tuning using TBA’s emulation tool controls, as well as the training of terminal planners. TBA is also the leader in equipment control software (ECS) for automated terminals, having supplied Euromax in Rotterdam, CTA in Hamburg and Antwerp Gateway.

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