

THE NEW MIMIC PANEL AND ITS EFFECTS ON SIMULATOR EDUCATION OF MARINE ENGINEERS AT ITU MARITIME FACULTY

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Abstract Simulator-based training is well recognized by the international convention of STCW'95. Engine room simulator consists of the simulation of various systems and machinery in the engine room of a ship.

ITU Maritime Faculty got a set of Kongsberg full-mission simulator and workstation simulators in 2001 by support of JICA. However, it was realized that it was not possible to create the real engine room conditions with this simulator due to lack of some operations on the mimic panel. And mimic panel was renewed in 2006.

The new mimic panel was specially designed by ITU Maritime Faculty and JICA personnel. All training courses especially Engine Room Team Management courses are effectively given with the new mimic panel.

In this study the properties of new mimic panel and its additional effects on education of students and engine room team management applications are explained.

Keywords ERS; ERTM; maritime education; STCW

0 Introduction

Simulators can be used as sophisticated, flexible and realistic training tools which are capable of meeting many of the designated functions and tasks specified in the STCW Convention. The greatest danger lies in simulation technology being used for training and assessment purposes and tasks for which the simulator is clearly not suitable or capable.

In developing STCW requirements for the use of simulators, the focus centered around defining standards of performance for simulators used in training and assessment, the thinking being much influenced by the requirement for mariners to clearly show that they were competent to do the job for the certificate or license being issued.

The purpose of the Standard is to ensure that the simulations provided by any maritime simulator include an appropriate level of physical and behavioral realism in accordance with recognized training/assessment objectives. The purpose is derived from the STCW Code Section A-I/12 where it is stated that each Party (i.e. the administration in the State where the training/assessment program shall be approved) shall ensure that simulator used under certain conditions shall fulfill six general performance requirements^[1]. The full text can be read in the Convention and the following is our interpretation of the essentials:

- suitable for training/assessment objectives
- physical realism appropriate to training/assessment objectives
- sufficient behavioral realism
- capable of producing a variety of conditions (operating environment)
- the learner can interact
- the instructor/assessor can control/monitor/record exercises

The increased use of marine simulators for training means that instructors must ensure that simulator training is not only effective but is also valid. To support this, it is important that training tasks relate to typical shipboard practices and that the simulator is capable of providing the appropriate operating environment. The transfer of simulator acquired skills to the real world is only a valid assumption provided that the training outcomes are satisfactory.

In this study, the deficiencies of the former mimic panel (Fig 1.) to form a realistic engine room environment, the properties of the new mimic panel (Fig 2.) which are created by eliminating the mentioned deficiencies and the educational gains of the new mimic panel is explained.

1 The ERS training in ITUMF

Maritime training institutions all over the world started to recognize the value of simulation systems as a training tool.

Engine Room Simulator is designed to simulate various types of machinery and equipment as used in the engine room of an actual ship. The main objective of ERS training is that the training is carried out efficiently, reliable with cost-effective configuration by simulating realistic environment.

The biggest advantage of using ERS as a training tool is the possibility of creating malfunctions repeatedly to train trainees for increasing their troubleshooting skills.

With the cooperation of Japanese International Cooperation Agency (JICA) and Istanbul Technical University Maritime Faculty (ITUMF), ERS of ITUMF was installed in June 2001.

ITUMF ERS consists of two types of ERS. One is CBT type ERS; the other one is full mission type ERS. The ERS has six units of CBT type ERS and one full mission type ERS. CBT type ERS is called WS. The trainee is able to practice the operation of the engine plant in individual or a small number of trainees on the Work Station (WS).

The full missions type ERS consists of the large-sized mimic panel which imitates an engine room, a control console which imitates a control room, an instructor console which imitates a bridge of an actual ship and a main switchboard which has same function as monitoring system and remote control system. By full mission type ERS; the trainee is able to practice more realistic operation than WS in suitable size of group.

Before the ERS training started the efficient methods for simulator training is considered and a training plan which is necessary for an efficient training is formed. The ERS training plan was created at ITUMF^[2]. The training plan indicates training subject, objectives, training method and evaluation type. The training plan contains simulator I and simulator II as training subject. Simulator I is realized as capability of the operational level depending on the competence of STCW convention. Simulator II is realized as capability of the management level depending on the competence of STCW convention. The aim of Simulator I training is that the trainees learns basic plant operation procedures such as normal start and stop each plant composition machinery, correct order of starting up the engine plant, the duty of the watchkeeping and recovery emergency situation. For this purpose we have prepared four objectives shown in Table 1.

Table 1 The ERS training plan

Subject	Objective	Method	Evaluation
Simulator I	Fundamental plant operation	WS checklists	Training report I
	Machinery operation	ERS scenario I	Evaluation sheet I
	Watchkeeping	Log book & Oil record book	Log book, Oil record book, Training report II
	Emergency operation	ERS scenario II	Evaluation sheet II
Simulator II	Plant operation management	ERS checklists	Training report III
	Team management	ERS scenario III	Evaluation sheet III
	Risk management	ERS scenario IV	Evaluation sheet IV
	Maritime communication	Communication phrases	Evaluation sheet V
	Internal & external communication		

The aim of Simulator II training is that the trainee learns higher skills concerning plant operation such as plant management and team management. It has been prepared four objectives for Simulator II training.

When the training courses were conducted according to this plan, although we created the training plan depending on the function of the ERS, we realized that there were some deficiencies in the mimic panel which should be improved to carry out “The ERS training plan” more effectively and more realistic as we proceeded with the training. In short, it might be said that the training by using the existing mimic panel would not bring accomplishment we expected when we created the plan. And also we thought that we were not able to expect any advancement in the educational quality in the future. Then, we began to ponder the necessity of renewing the mimic panel.

2 The new mimic panel

ERS comprises mimic panel, control console, main switch board and instructor console. The mimic panel represents an actual engine room and it is the most significant component among the

system components to carry out an effective ERS training. Regarding the former mimic panel, there were lack of functions and all the necessary procedures from starting up the propulsion plant to the state of navigation cannot be done on the panel. Under processing the operation of the former mimic panel, we needed to press the key board to continue the procedures. The Fig. of the former mimic panel is seen at Fig. 1. It causes the trainees confuse and interrupts their comprehension. Therefore, renewing the mimic panel was necessary to implement an effective ERS training. Renew of the mimic panel was officially requested in February 2004. The sequence of the request to installation of the new mimic panel took place as follows:

- Drawing the design of the new mimic panel was begun by ITUMF team and JICA personnel in November 2003.
- Discussion on necessity of the new mimic panel was started in November 2003.
- The first version of the drawing of the new mimic panel was completed 'n February 2004.
- One engineer from Kongsberg came to the faculty to have a technical discussion in February 2004.
- One engineer from Kongsberg came to the faculty to have technical discussion.
- Official letter requesting the new mimic panel was submitted in February 2004.
- The final evaluation of the project was implemented and the necessity of the new mimic panel was approved in November 2004.
- Installation of the new mimic panel was completed in January 2006.



Fig.1 The former mimic panel

2.1 Design concept of the new mimic panel

Before design period of the new mimic panel, the following points are considered for the new

mimic panel concept which is for modifying the mimic panel to a superior level with which the standard is reached and the all level courses and ER Team Management Course can be executed:

- (1) The existing soft ware should not be changed.
- (2) All necessary procedures related to starting up the propulsion plant can be done on the panel.
- (3) For the trainee's monitoring, as many analogue meters as possible should be mounted on the panel.
- (4) GSP (Group Starter Panel) should be adopted and placed on the lower part of the panel.
- (5) Main engine ignition indicator lamps should be adopted to realize the difference between engine running and inertial rotation.
- (6) A propeller model should be mounted to make a realistic environment and makes it rotate by the revolution signal.
- (7) The size of the panel should be 2,500mmH×10,600mmW×400mmD approximately in consideration of the room size.
- (8) AVR (Auto Voltage Regulator) and dedicated UPS for the panel should be adopted to avoid interruption caused by power supply.

The new mimic panel and the differences can be seen at Fig. 2.



Fig. 2 The new mimic panel

2.2 Designing the new mimic panel and specification

During the design period according to the determined concept above, the structure and the characteristics for a realistic mimic panel were considered and summarized below:

- (1) All necessary systems for propulsion plant were described and their layout was newly arranged.

- (2) Each system was described in consideration to reality as much as possible and easy to understand what configuration it has.
- (3) GSP was placed on the lower part of the panel as a part of the panel construction. Switches and indication lamps were mounted in consideration to reality as much as possible and they have same function as an actual GSP.
- (4) Instruments such as switches, lamps and analogue meters, on the mimic panel were chosen in consideration to its mounting area and its height from the panel surface. Particularly, the boiler frame indication lamp was made with special specification.
- (5) Color arrangement was chosen in consideration to no outstanding line and illustration but easy to identify them.
- (6) At the beginning, it was planed that the structure of the mimic panel was made of steal plate and acrylic plate in consideration to strength, finish and protecting surface and illustration should be described on the rear side of the acrylic panel by digging. However, it was decided through the discussion that the structure of the panel was made of aluminum plate and acrylic plate and illustrated mimic sheet should be pasted on the aluminum plate. Regarding the surface of GSP, it should be covered with poly-carbonate film coating to protect the surface from injury.

The differences between the new mimic panel and the former mimic panel are listed in the Table 2.

Table 2 The differences between the new mimic panel and the former mimic panel

Items		The new mimic panel	The former mimic panel
Structure		2 mm acrylic plate and 3 mm aluminum plate covered with illustrated mimic sheet	3 mm acrylic plate illustrated on the rear side by digging
Dimension (m)	Total width	10.8	7.2
	Height	2.3	2.3
	Depth	0.5	0.5
Layout		Main engine was placed on the center and whole layout was completely rearranged.	Bunker system and bilge system were placed on the center.
Additional systems		All cylinders were illustrated.	5 cylinders were illustrated
		All cylinder heads and all attached valves were illustrated.	Only 5 cylinder heads with no attached valve were illustrated.
		ME ignition indicator lamps were added.	Non
		Steering system was additionally illustrated and instruments concerned were added.	Non
		Refrigerant system was additionally illustrated and instruments concerned were added.	Non
		Emergency generator system was additionally illustrated and instruments concerned were added.	Non
		Engine room fans were additionally illustrated and instruments concerned added.	Non

		GSP was additionally placed and instruments concerned were added.	Non
		Bow thruster was added.	Non
Number of instruments	Switches	724	493
	Indication lamps	285	56
	Analogue meters	174	7
	Model Propeller	1	Non
	Process Cont.	44	44

3 The educational gains of the new mimic panel

The deficiencies we realized have been recovered and the function by using the mimic panel has been improved in terms of the following respects:

- It became easy to understand the system configuration of the propulsion plant due to the rearrangement of the layout,
- It came to be able to perform all the procedures to start up the plant on the panel, (The key board of PC to carry out the operation of the plant became unnecessary any longer)
- Monitoring by the trainee standing in front of the panel became possible due to the analog meters which increased sharply in number,
- The mechanism of starting and stopping pumps had been completely changed and the same operation as an actual operation to start and stop pumps became possible and also the trainee can realize whether stand-by pump is actually in stand-by condition in dual pump system due to the additional stand-by indication lamps,
- Rearranged layout of the plant, more realistic illustrations, the model propeller, main engine ignition indicator lamps and special designed boiler flame lamp were very effective to create more realistic environment for the training and successful to improve trainee's motivation.

Table 3 The differences between the new mimic panel and the former mimic panel in

	mechanism	of starting and stopping pumps
	The new mimic panel	The former mimic panel (MP)
Single pump system	Press "START" on GSP to start Press "STOP" on GSP to stop	Press 'START' on the MP to start Press again "START" on the MP to stop
Dual pump system	Press No1 "START" on GSP to start Set No1 & No2 "COS" on GSP to "AUTO" to make them S/B. (No2 S/B lamp will be lit)	Press No1 "START" on the MP to start Press again No1 "START" on the MP to stop Press No2 "START" on the MP to

		start Press again No2"START" on the MP to stop. (There were no S/B indication lamps)
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The new mimic panel yields the advantage of conducting all level courses and ER Team Management Course. Therefore by these courses the students and the applicants from companies would develop higher level skills than before such as:

- risk management;
- team working understanding in the engine room and leadership practices;
- "Internal" and "external" communication skills development in the engine room.

Scenarios for simulating situation where management of panic condition is needed at most emergency procedures.

Case studies to reflect the real situation where team management is evaluated.

Utilize resources and personnel effectively.

The new and the former form of pump start stop mechanism is depicted at Fig. 3 and the details are listed at Table 3.

3.1 Simulator I training with the new mimic panel

The Simulator I Course training items are machinery operation, watch keeping, and emergency operation. The trainee can learn unusual operation methods such as manual operation and emergency operation etc. about the selected machineries through this training. The aim of the machinery operation is familiarization of the operation for selected machineries by utilizing full mission ERS.

The aim of the watchkeeping is that trainee learns how to take over the duty of the watch by using full mission ERS. The training which duty of watch keeping is taken over to the other trainees is performed.

The objective of the emergency operation is that trainee learns how to recover emergency situations such as black out, ME shut down, ME auto slow down, Oil fired boiler burner trip, etc. Mainly, under the state of navigation, making an emergency malfunction intentionally, a trainee performs operation for recovering it to a normal state.

Because the new mimic panel can provide more realistic environment and operation conditions, it is possible to reach the aims and objectives mentioned above with the new mimic panel.

3.2 Simulator II training with the new mimic panel

The Simulator II Course training items are team management, risk management, maritime communication

3.2.1 Team management

In a crisis, a leaderless group will achieve nothing. A simulator is a valuable tool for

demonstrating how good leadership is vital for establishing and motivating team effort. The highest priority of a team is to accomplish team goals. If those qualifications are lacking or missing them effective machinery space management will break down and the ship will be thrown into a risk. Achieving those qualifications is very important, that's why this objective is set up.

For this purpose, trainee learns team play under proceeding plant operation such as start up the engine plant, stand by station for entering/leaving port and emergency operation.

The former mimic panel was not sufficient for team organizations to study more efficiently due to absence of some systems and lack of instruments. The new mimic panel increased team training performance.

3.2.2 Risk management

To reduce the human errors, training for troubleshooting repeatedly with a good communication and team working is needed and therefore, utilization of ERS for this purpose is proposed. For this purpose, this part of the course is about to increase the ability of trainee over the control of risk.

The objective of the risk management is that trainee learns how to take counter measures by predicting an emergency state from the running date which is in the out of the normal range. Mainly, under the state of navigation, for example, it is performed by taking necessary counter measures after detecting high temperature of scavenging air caused by fouled surface of the air side of air cooler.

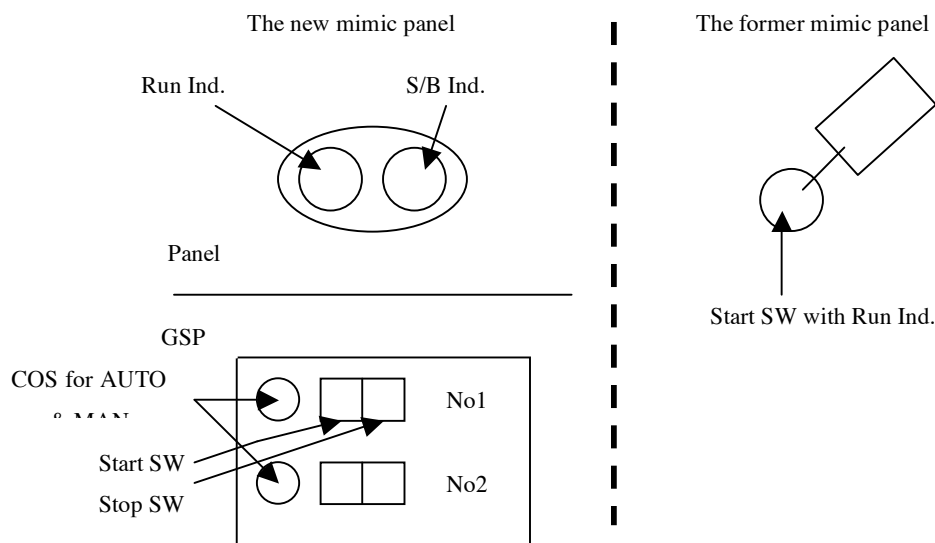


Fig. 3 The mechanism of starting and stopping pumps

The lack of instruments is delaying the beginning of perception of undesirable process. Even more it is causing more complex procedures than normal procedures for intervention. On the other hand, risk management is aiming to teach to implement the true procedure at true time in the fastest way. Because all systems and necessary measurement instruments can be seen on the new mimic panel, risk management training can be executed properly.

3.2.3 Maritime communication

Communication in the engine room is so important in terms of eradicating of marine accidents which are considered to be based on communication failures.

The maritime communication is to learn how to communicate with other staff members in the engine room and how to communicate with the bridge, further more to learn technical terms. It goes without saying that communication both in an upward and downward direction is vital for good management, both in day to day routines and in crisis. ERS can be utilized to demonstrate that, without good communication, tasks are made much harder due to lack of direction and misunderstanding.

With the new mimic panel it is possible to operate the whole system on the mimic panel. Therefore, the internal communication can be done more clearly and realistic.

3.3 Ertm training with the new mimic panel

ERTM training is different from Simulator I and Simulator II Courses. This Course is specially designed for marine engineers who have see going experience as engineer officer. This course is for team working understanding in the engine room and practices. The main principle of team management related to the non-technical skills associated with the social interaction between team members, situation awareness and the decision-making. This is a high fidelity, complex, simulated working environment. The course covers:

- Organization and Procedures
- Team Building and Development
- Situational Awareness and Error Trapping
- Internal and external Communications
- Management of Stress and Distractions
- Fatigue and Circadian Rhythm
- Leadership and Group Decision Making
- Multicultural Diversity

This course duration is four days. Teaching methods cover lectures, simulator exercises, pre reviews, debrief sessions and case studies.



Fig. 4 A Photo of ERTM Course with Engineers

The course works best with a team of varied ranks and we recommend a complete engine room team of Chief Engineer, First/Second Engineer, Second/Third Engineer and Third/Fourth Engineer. The course can accommodate a maximum of four officers and a minimum of three officers. A photo of a training team is shown at Fig. 3.

This course is started after the new mimic panel is installed. By this course, the trainees not only refreshing their knowledge but also increasing their team management knowledge, skill and ability.

4 Conclusion

For the effective training with simulators the simulator environment should be as real as the engine room. By the changes of former mimic panel ERS is now more appropriate to real engine room environment.

With the new mimic panel it is possible to give marine engineering candidates higher level qualifications. For example, the use of ERS for team-management and for communication skills could very efficiently be arranged because of the opportunity of preparing the scenarios based on the type of the training and education. Through this type of training, marine engineer candidates can easily learn the safety culture, how to manage the risk and the aspect of the human error.

After the new mimic panel installed and the courses carried out, the importance of ERTM courses is understood. And many shipping companies have applied for the ERTM course and many courses have carried out in a more realistic machinery space simulator.

Acknowledgements

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Reference

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