Maritime Engine Room Simulator online - MERSol

Captain Heikki Koivisto, Faculty of Logistics and Maritime Management, Satakunta University of Applied Sciences, Suojantie 2 26100 Rauma, Finland
heikki.koivisto@samk.fi
Orcid: 0000-0002-8955-6421

Prof. German de Melo PhD (Eng), MSc (Eng), MSB, CMarEng, MIMarEST, MASME) Faculty of Nautical Studies of Barcelona, Polytechnic University of Catalunya, Pla de Palau, 18, Barcelona, 08003, Spain
german.de.melo@upc.edu.
Orcid: 0000-0001-9212-6476

Prof. Dr. Taner Albayrak, Faculty of Economics and Administrative Sciences Department of Maritime Business Management Piri Reis University, Postane Mahallesi Eflatun Sokak No: 8 34940 Tuzla İstanbul – Turkey
talbayrak@pirireis.edu.tr
Orcid: 0000-0002-4743-9235

Gintvile Simkoniene, Maritime Electrical Equipment Exploitation Department of Lithuanian Maritime Academy, I. Kanto str. 7, Klaipėda LT-92123, Lithuania
g.simkoniene@lajm.lt
Orcid: 0000-0003-0970-1826

PhD Artem Ivanov, Department of Ship Electrical Equipment and Automatic Devices Operation of Kherson State Maritime Academy, 20 Ushakova avenue, Kherson, 73000, Ukraine artiva1978@gmail.com
Orcid: 0000-0002-1919-2570

ACKNOWLEDGMENTS

ERASMUS+ KA226 Partnerships for Digital Education Readiness (in the fields of school education, vocational education and training, and higher education) and Strategic Partnerships supporting innovation (relevant for all fields of education): development and implementation of innovative, concrete, and long-lasting outputs.

Kherson State Maritime Academy, Ukraine fulfilling their partner commitment even Russia attacked their county and started a war.

Keywords

Online study and assessment modules, online Engine Room Simulator, MERSol

Abstract

The STCW International Convention of IMO sets minimum qualification requirements for being a seafarer and is used in formal training of seafarers. A skills gap has emerged between traditional Maritime Education; the needs of the industry and seafarers ought to be able to apply increasing complex systems, regulations, and technologies especially when pandemic occurred, and traditional teaching method could not be used.

MERSol-project developed seven study modules followed with assessment study modules ensuring the level of the theory knowledge. All related new regulations are included and tested in these assessment modules. Specific software, Engine Room Simulator (ERS) online by modern technology and digitalisation is the main product of the project. The first tests of Engine Room Simulator online have just finished before the 2022 Maritime Transportation Conference and the first findings will be published during this conference. MERSol supports the uptake of innovative approaches and digital online technologies for teaching and learning online to ensure qualifications requirements to be addressed.

Designing and developing the study modules and assessment modules on a specific e-learning delivery platform allows cadets and seafarers to access the training program and learning materials over the internet at any time and any place. This is particularly relevant in the Maritime sector where seafarers are highly mobile and have less opportunity to take long face-to-face training courses whilst they are working. Primary target groups are new marine engineer cadets but also deck cadets and all mariners already at sea to update their knowledge of automation and digitalisation. Also, all European HEI and VET centres, together with maritime industry are target groups taking into consideration ship building and ports.

1 INTRODUCTION

Shipping industry had been significantly affected by the COVID-19 pandemic, and whilst the biggest challenge is seen to be crew changes, the impacts of the COVID-19 pandemic on maritime education and training and the supply of qualified and certificated seafarers is a growing area of concern for the industry. Shipowners and operators need to pursue a close relationship with Maritime Education and Training (MET) institutions, and this would also be crucial when working towards the next comprehensive revision of the STCW Convention and Code.
Due to impact of the COVID-19 pandemic on the delivery methods of MET, physical lectures, workshops, simulators and other practical classes where students and lecturers were required to interact in close proximity and/or students were required to use equipment and machines, were challenging to deliver because requirements for physical distancing often impacted on the numbers of students that could be present at any one time and/or cleaning and disinfection protocols often took time away from time available to use the

equipment or machines.
Distance and remote learning posed new challenges as students and lecturers alike could have problems with internet connectivity, IT devices, familiarization with the online platform, and there were seen to be limits to the number of hours that could be provided online compared to, for example, physical lectures. Difficulties arouse holding in-person assessments and exams where students and lecturers are unable to attend the maritime universities due to restrictions or public health measures. All MET Institutions tried hard to develop special schedules and rotations to maximize use of classrooms, simulators, and workshops within the parameters of public health measures and guidance.

Refreshment training were also hampered due to difficulties for cadets to move and travel to/from ships due to logistical and planning challenges resulting from the COVID-19 pandemic, such as the lack of flights, travel restrictions and other public health measures which resulted challenges to conducting timely and predictable crew changes which are necessary to fit in with MET institution schedules and welfare of the cadet.
These problems caused reduced intake of new entrants by the maritime education institutions to ensure that all enrolled cadets can have the opportunity to receive the onboard training and seagoing service experience required to qualify for the issue of their first certificate under the STCW Convention.

In view of ongoing COVID-19 pandemic significant impacts on MET and likely future crisis that may have a long-lasting impact, making it a growing area of concern, that requires urgent attention from the relevant stakeholders, the MERSol team was established to overcome one main and vital issue – online engine room simulator training.

Today nearly all maritime training institutes, specialised to train the marine engineers, are having a maritime engine room simulator. Wärtsilä and Kongsberg are the market leader manufacturers. Nowadays having an engine room simulator is like earlier having a chalk board. Some countries accept even engine room simulator days as part of the on-board training programme; for example, in Finland the flag state approves reported, minimum six hours lasting and instructor accepted days as on-board training up to 30 days of 360 days of total on board training required, before granting Officer of the Engineering watch (OOeW) Certificate.

2 PROJECT TEAM

MERSol – project (Maritime Engine Room Simulator online) was invented due to covid-19 that made face-to-face simulator lessons mostly impossible. Satakunta University of Applied Sciences (SAMK) from Finland had the leading role to set the consortium, as this project application was sent to Finnish National Agency for Education, Opetushallitus. SAMK invited maritime training partners from Lithuania, Lietuvos aukstoji jureivystes mokykla (Lithuanian Maritime Academy, Klaipeda), Spain, Universitat Politecnica de Catalunya (Nautical Studies of Barcelona) Turkey, T. C. Piri Reis Universitesi (Maritime University of Piri Reis, Istanbul) and Ukraine (Kherson State Maritime Academy, Kherson) to join as marine engineering specialist. Two SMEs were invited as well; simulator

manufacturer Image Soft Ltd. from Finland, and online teaching tool specialist Spinaker proizvodnha trgovina in trzenje doo from Slovenia. Some of the project partners have already shared ERASMUS+ projects for nearly 20 years, and some had had previous bilateral cooperation, but also new partners in ERASMUS+ were in the consortium, which was then found strong to prepare the actual application.

3 PROJECT APPLICATION

The European Education and Culture Executive Agency, EACEA, opened an additional call for proposals as part of the measures supporting recovery from the coronavirus crisis. The funding in the additional call was granted to Erasmus+ KA2 strategic partnerships. The application period was very short, only few months but the MERSol consortium was successfully submitting their application by the deadline 30th October 2020. The funding in the additional call for proposals for strategic partnerships was granted to projects that address one of the following two priorities: Innovative practices in a digital era, or Skills development and inclusion through creativity and the arts.

The applications were assessed following the common EACEA award criteria: relevance of the project, quality of the project design and implementation, quality of the project team and the cooperation arrangements and finally impact & dissemination. The decisions on the applications submitted in Finland were made by the Erasmus+ National Agency in Finland – the Finnish National Agency for Education, based on the evaluation made by external experts in the funding programme.
According to the evaluation report, MERSol-project equips well the marine education and training systems with new digital tools and highly promotes innovative methods for learning and assessment as improvements in education and lifelong learning. The report stated that the project can be expected to produce results that are innovative for its field. The innovative dimension relates to the online based simulation system providing an opportunity to train (and assess the learning of) future and current professionals in the marine industry. The project addresses issues relating to technological development and EU's emission reduction policy. The project will add to existing knowledge in the participating organisations and knowledge transfer will take place amongst partners and beyond. The persons involved are likely to gain competence by taking part in the project activities and it is likely to remain for a long period of time. The proposal addresses an EU level (and global) challenge and transnationality adds value to the project results. Such results would not be achieved by activities carried out in a single country.

The project involves five relevant HEIs (Higher Education Institutions) and two SMEs across EU and in Ukraine, each bringing expertise required to implement the work programme. Skills, expertise, and management support from each partner are clearly identified in the proposal. The role of the SMEs is vital in the technical expertise and development of the online version of the simulator Associated partners include stakeholders relevant to the field. Support letters show interest in the wider marine education and training community. MERSol is a two-year ERASMUS+ project started at 1st June 2021 and lasting to 31st May 2023.

Project is divided into three Intellectual Outputs, IO1 study and assessment modules, IO2 ERS online and IO3 guide for related industry. During the project time there are partner meetings face-to-face, but especially when developing study and assessment modules together, bi-monthly online meetings have been and are in the agenda. Developing and testing is in a focal role in this project, therefore, in September 2022 an engine room training session will be arranged in Rauma, Finland, but also online at all the partner universities. One part of this session, MERSol - Maritime Engine Room Simulator online testing event, has been offered to EMD22 (European Maritime Day) events on 22nd September 2022. There will be a link at merilogistiikka.fi/en to the study modules and ERS online. The event will be promoted on Facebook, Twitter, and LinkedIn.

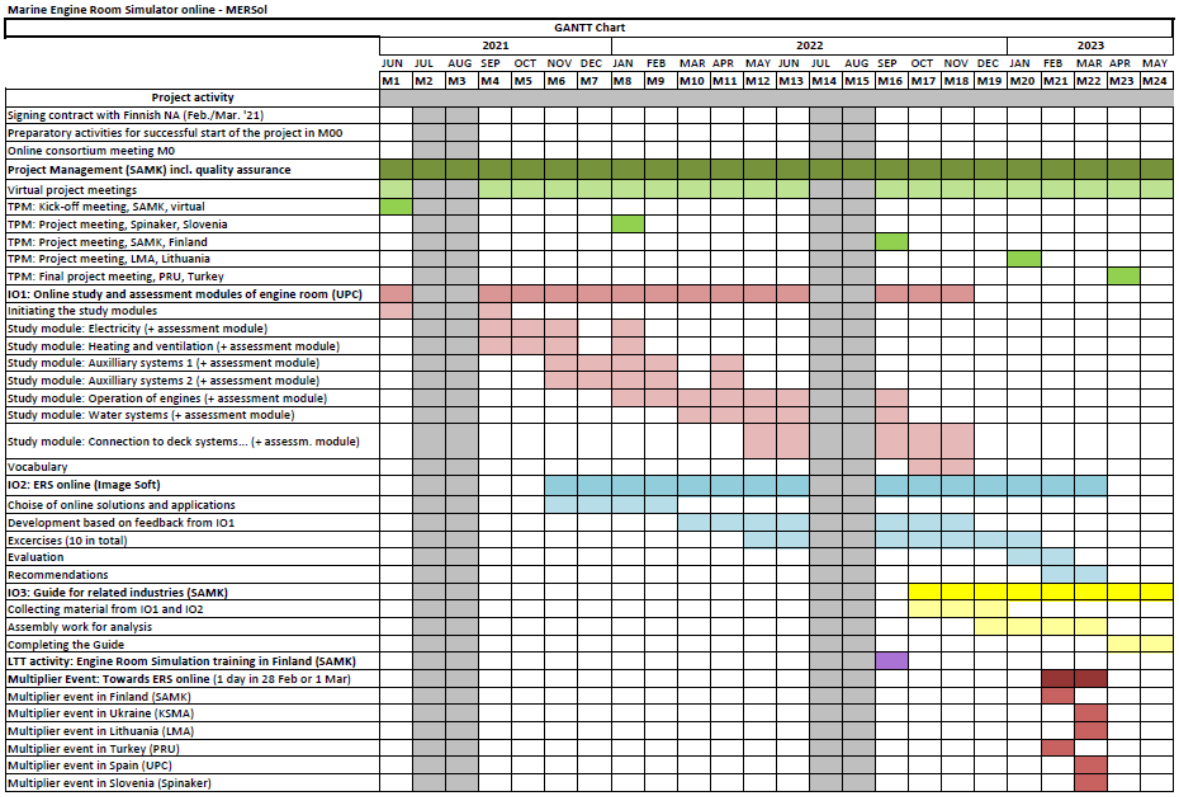

Fig 1. Gantt chart of MERSol – project (Maritime Engine Room Simulator On-Line application)

4 STUDY AND ASSESSMENT MODULES

MERSol-project has developed new ship related, high class and up-to-date study modules followed with assessment study modules.
Modules are set on Moodle-platform. For the testing purposes only one server is used in the beginning of the project so that all partners are using the same exercise, especially developed by project partners. When online technology is steady and reliable to run this one exercise from several partner computer there is a plan to test several servers at one time

to evaluate the maximum limit of online users.

Modules are as following:

Study module	Topics
Electricity	Electric motors (electric propulsion), electric power plant, diesel generator, emergency generator, shaft generator, shore connection, batteries, and fuel cells
Air conditioning	Steam, thermal oil, ventilation of machinery spaces
Auxiliary systems 1	Fuel- and lubrication oil (bunkering, storage, transfer, purifying, feeding), exhaust gas scrubbers- cooling (sea water, LT & HT), starting air, air pressure systems
Auxiliary systems 2	Bilge (main bilge, oily bilge), ballast water treatment, fire protection systems (water fire extinguishing, CO2)
Operations of engine	Monitoring, controlling, automation
Water systems	Fresh water, technical water, water production
Connection to deck systems and bridge connection	
Vocabulary (with explanation)	

Table 1. List of study modules (Maritime Engine Room Simulator on-line application)

Designing and developing the study modules and assessment modules on a specific e-learning delivery platform allows cadets and seafarers to access the training programme and learning materials over the internet at any time and any place. This is particularly relevant in the Maritime sector where seafarers are highly mobile and have less opportunity to take long face-to-face training courses whilst they are working.

Primary target groups are new marine engineer cadets but also deck cadets and all mariners already at sea to update their knowledge of automation and digitalisation. Also, all European HEI and VET centres, together with maritime industry are target groups taking into consideration ship building and ports. MERSol study modules, assessment modules and ERS Online will not only provide this as training for new Cadets, but also as part of continuing VET for already qualified seafarers. Together with the Multiplier Events organised in each participant country for wide exploitation and dissemination, all partners will utilise their dissemination networks and will involve EU wide networks in the project. Even up to 14,000 persons are expected to be reached within the project lifetime.

This first output, study, and assessment modules is led by Prof. German de Melo from the

Faculty of Nautical Studies of Barcelona, Polytechnic University of Catalunya, UPC. Each maritime training partner has own modules to produce and other partner to make the first quality check. Each partner will then comment and finally UPC completes the final study module. The template for "MERSol study module" was invented by Professor Tolunay Kayaarasi from Piri Reis University, Turkey. Assessment modules are done following similar formula. They can be used separately if candidate has strong commitment on his/her knowledge.

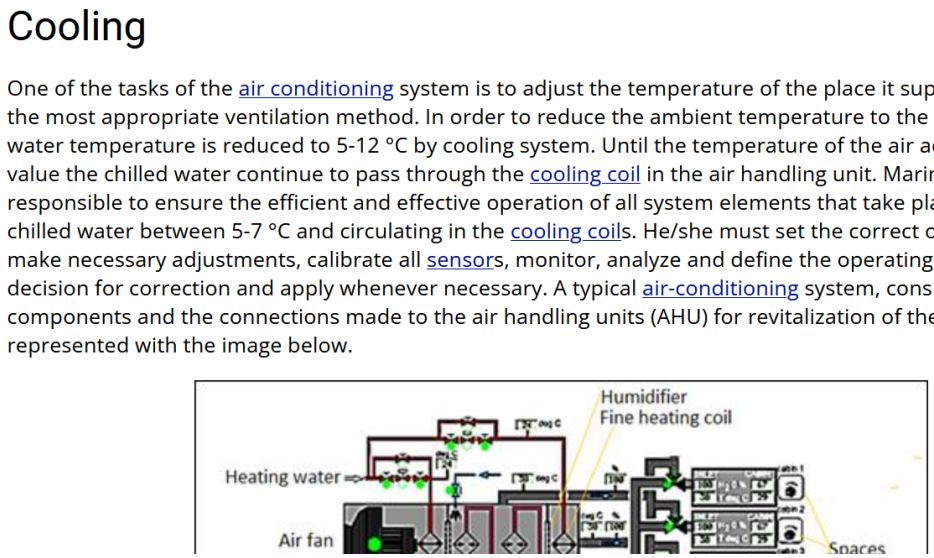

Fig.2 Screen shot from MERSol moodle, module 2 air conditioning

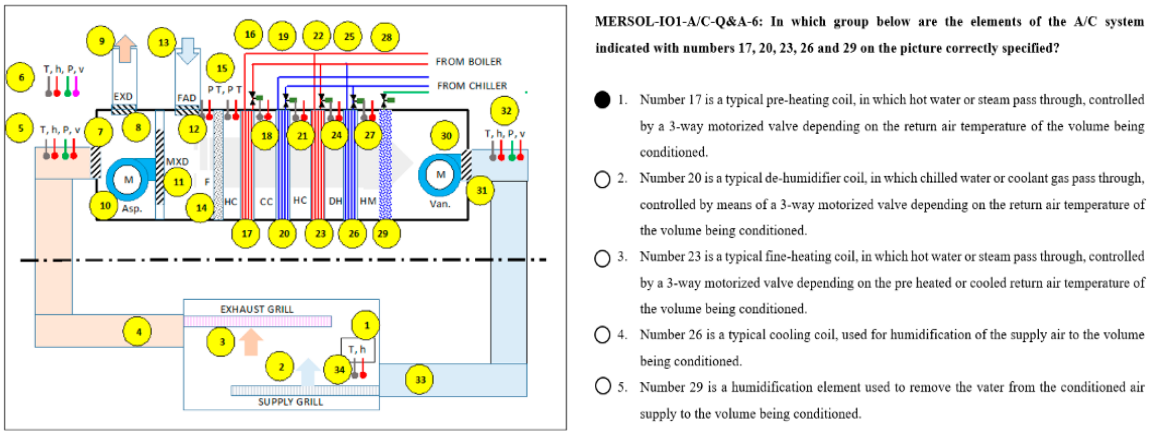

Fig 3. Screenshots from the assessment module

5 ENGINE ROOM SIMULATOR ONLINE

In IO2, the specific software, ERS online, will test the knowledge in online practice. MERSol supports the uptake of innovative approaches and digital online technologies for teaching and learning online to ensure these qualifications requirements to be addressed. Finnish simulator manufacturer Image Soft Ltd. became one MERSol partner, as they had developed an Engine Room simulator based on a ship model of a research vessel.
There is an introduction session before entering the actual engine room simulation. IMO model course 2.07 Engine-room simulator, 2017 edition was of assistance in the preparation of the ERS and exercises.

Once the knowledge established in part A of the STCW Code, Standards of Training, Certification and Watchkeeping for Seafarers, Sections A-III / 1, 2 and 3 has been acquired, the student can simulate all the Start-up operations of the main and auxiliary machinery of the ship with knowledge of each step to be carried out in a similar way to that which would be carried out in a real engine room.
There is a wide variety of machines and systems used for different purposes, connected to the automation system on merchant ships. These machines and systems may differ depending on the designs of the manufacturers. However, the goal-oriented working and operating principles are the same. For this reason, the main aim is to learn the operating principles of these machines instead of learning one by one. These machines can work alone or together to form a system. Learning the principles of effective remote command and control, if they are connected to the automation system, is now the main element of modern ship machinery management.

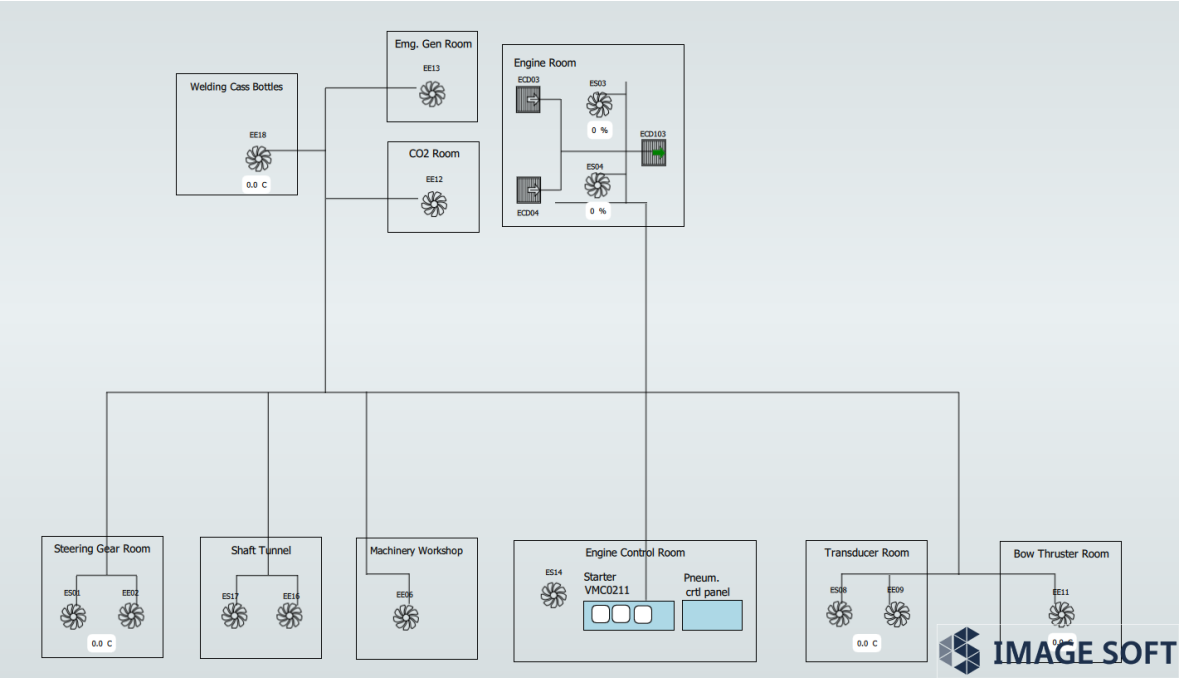

Fig 4. Air conditioning, screenshot from the ERS (Image Soft Ltd: ERS of a research vessel)

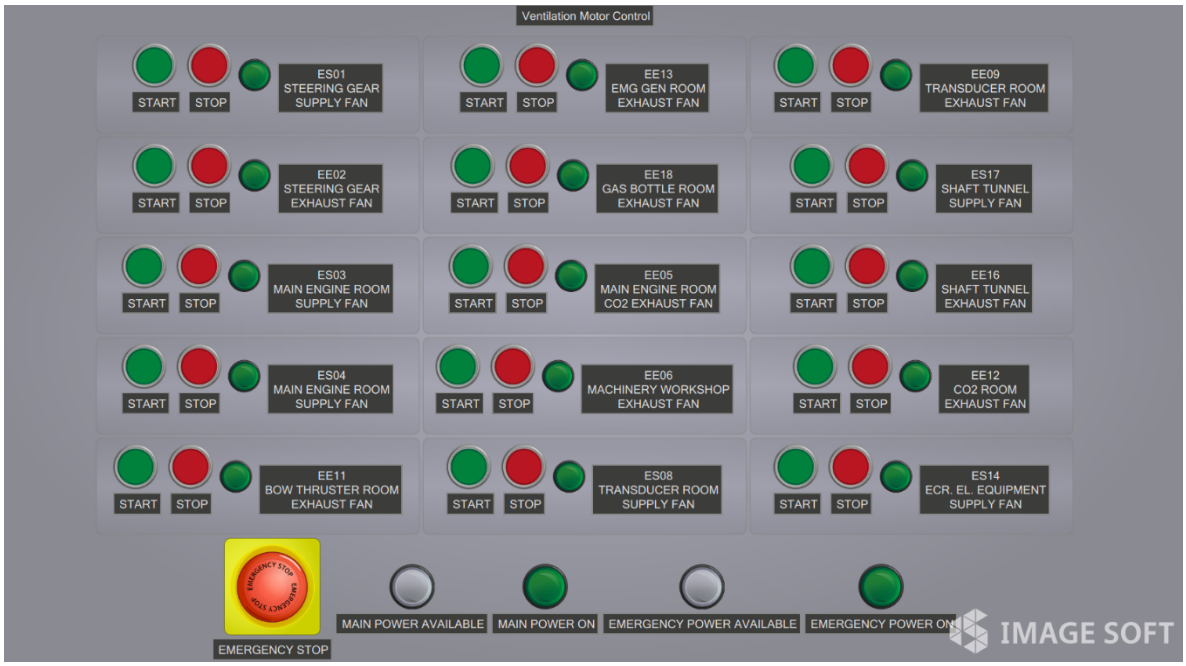

Fig 5. Ventilation control, screenshot from the ERS (Image Soft Ltd: ERS of a research vessel)

First online simulator tests are taking place in a small scale to evaluate all possible needs to ensure ERS running smoothly. Several tests are planned for the project timespan, and MERSol team is more than keen to meet possible challenges running ERS online.

EMD 2022 (European Maritime Day), the annual EU meeting point on maritime affairs and sustainable blue growth, and the place where 'Ocean Leaders Meet', will take place in Ravenna, Italy on 19th & 20th May 2022. As every year, this will not be the only action to celebrate our seas and oceans. EMD In My Country 2022 events will also take place all over Europe from 1st April till 31st October 2022. As part of these events on 22nd September 2022, very first public online MERSol ERS online event is taking place online. This day will also be the last day of the three of staff training days as part of the MERSol project.

6 GUIDE TO RELATED INDUSTRIES

At the final phase of the MERSol project, from October 2022 to May 2023, SAMK will lead the work to complete a guide to related industries. Material will be collected from the first two intellectual outputs, IO1 study and assessment modules, and IO2 ERS online, and share the best practises and especially lessons to learn. Already we can highlight the importance of a well-working consortium and that the engine room simulator is not at all a computer game. Student will learn the different steps to be carried out to put the plant into operation and once achieved, the project objectives are achieved, thus we have reached the goal.

There are several similarities to related industries, as marine engineers are fully responsible

for the sustainable operation of the ship systems and machines in accordance with a serious discipline. Operating the ship systems and machines by the Marine Engineers must stay economic, continuous, efficient, secure, safe, and environmentally friendly. Therefore, Marine Engineers are fully responsible to monitor and analyse the running parameters, define the conditions, make decisions, and take corrective actions when necessary.

7 CONCLUSIONS

Working onboard a ship is a world of its own. Knowledge to solve possibly appearing problems must be available in the crew. MERSol project offers up-to-date study and assessment modules for distance learning and testing this knowledge. Engine room simulator online gives an opportunity to run engine room operations safely and tests the user to solve different malfunctions in the operations. MERSol team, Satakunta University of Applied Sciences and Image Soft Ltd form Finland, Maritime Academy from Lithuania, Nautical Studies of Barcelona from Spain, Piri Reis Maritime University from Turkey, Spinaker Ltd. from Slovenia want to express their full support to brave Ukrainian people fighting against Russian intruders.

REFERENCES

European Commission. *Maritime Engine Room Simulator On-Line application: 2020-1-FI01-KA226-HE-092597.*[Programari de simulació].

International Maritime Organization. *Engine-room simulator: model course 2.07.* London: IMO, 2017. ISBN 9789280116762.

Image Soft Ltd. IS Engine room simulator [Programari de simulació]. Helsinki: Image Soft Ltd.[Accessed: June 2022]. Available at: <https://imagesoft.fi/product/is-engine-room-simulator/>.

MERSol moodle platform.