**RESEARCH STUDY ABOUT CONNECTING SOLUTION**

**OF SIMULATING FACILITIES OF PARTNERS**

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1. **Introduction**

The maritime industry plays a vital role in global trade and transportation, demanding a highly skilled workforce. To meet the industry's evolving needs, maritime education and training have undergone substantial changes in recent years. This paper explores the trends and innovations that have shaped the field, addressing the challenges faced and the potential solutions to ensure the industry's continuous growth.

1. **Literature Review**

Global trade is the lifeblood of the maritime industry. Without it, the industry would simply not exist. The shipping industry is responsible for transporting and delivering around 90% of shipping in the world is carried through the sea.

Shipping is a truly international industry and can only function effectively if regulations and standards are themselves agreed, adopted and implemented internationally.

The forum where this process takes place is the Internationa Maritime Organisation (IMO).

The main mission and responsibility of IMO is to develop and preserve a comprehensive framework of regulations and policies like maritime security, safety, technical cooperation, environmental concerns and legal matters.

The four pillars of IMO are the International Convention for the Safety of Life at Sea (SOLAS), International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), International Convention for the Prevention of Pollution from Ships (MARPOL) and Maritime Labour Convention (MLC).

STCW is one of the most important regulations for merchant mariners and establishes minimum training requirements for all personnel serving onboard ships. These standards cover personal survival techniques; fire prevention and firefighting; medical first aid; maritime security awareness; communication; leadership; teamwork & human behavior.

The STCW Convention has been updated and revised several times since its original ratification in 1978. The most recent revision was in 2010, also know as the Manilla amendments.

Its primary purpose is to uphold safety standards and ensure that seafarers possess the necessary knowledge, skills, and training to perform their jobs effectively and efficiently.

The implementation of standards incorporated in maritime safety and pollution prevention-related instruments adopted by the IMO, including the STCW Convention and Code are made in academic organizations and institutions.

1. **Advancements in Maritime Education**

***3.1 Technology Integration***

Advances in technology have significantly impacted maritime education and training.

The Section A-I/12 of the STCW Code set the standards governing the use of simulators in training and assessment of competence.

Acording to STCW Code the simulators which can by used for training or assessment of competency are for:

1. Training and assessment in radar observation and plotting
2. Training and assessment in the operational use of Automatic Radar Plotting Aids (ARPA)
3. Training and assessment in the operational use ofvElectronic Chart Display and Information Systems (ECDIS)
4. Non-mandatory types of simulation
   1. Navigation and watchkeeping simulation
   2. Ship handling and manoeuvering simulation
   3. Cargo handling and stowage simulation
   4. GMDSS comunication simulation
   5. Main and auxiliary machinery operation simulation

STCW Code provide guidelines (Section B-I/12 of the STCW Code) regarding the simulators used in radar observation and plotting, ARPA and ECDIS.

In the educational process, the simulator is a means by which several specialty learning objectives can be achieved. The maritime simulators are used in the learning process because the virtual environment can simulate unusual naval situations and for economic reasons.

The maritime simulators integrates modern equipment that manage to provide virtual training in terms of gaining onboard standard routine for seafarers and to improve the safety in exploiting of the vessels.

Maritime simulators play a crucial role in training and preparing maritime professionals for various scenarios they might encounter at sea. Here's an overview of their capabilities, strengths, and potential weaknesses:

1. **Capabilities:**

* ***realistic environment*** -simulators can recreate realistic maritime environments, including different weather conditions, sea states, and navigational challenges;
* ***comprehensive training*** - they allow for comprehensive training across different aspects of maritime operations, including navigation, ship handling, engine room operations, and emergency response;
* ***scenario replication*** -**s**imulators can replicate specific scenarios such as harbor approaches, navigation through challenging channels, and emergency situations for effective training;
* ***risk-free learning*** - **s**imulators provide a risk-free learning environment, allowing trainees to make mistakes and learn from them without real-world consequences;
* ***repeatable exercises*** - training scenarios can be repeated and adjusted to reinforce learning and improve competency;
* ***customization*** -simulators can be customized to simulate different types of vessels, making them adaptable to various training needs;
* ***performance evaluation*** -they allow for objective performance evaluation, tracking trainee progress and identifying areas for improvement;
* ***interoperability*** -some simulators offer interoperability, allowing for integrated training scenarios involving multiple simulators and different types of vessels.

1. **Strengths:**

* ***safety enhancement*** - simulators contribute to safety by allowing trainees to practice emergency procedures and responses in a controlled environment;
* ***cost savings*** - simulators can reduce training costs associated with using real vessels, fuel, and maintenance. They also minimize the risk of accidents during training;
* ***Adaptability*** - simulators can be updated to reflect changes in technology, regulations, and vessel designs, ensuring training remains relevant;
* ***crew familiarization -*** simulators assist in familiarizing crews with new vessels before they go into service, reducing the learning curve during actual operations;
* ***24/7 availability*** - simulators can be accessed at any time, allowing for continuous training and skill development.

1. **Weaknesses:**

* ***initial cost*** - acquiring and setting up high-quality simulators can involve a significant initial investment;
* ***limited physical feedback*** - simulators may lack the physical feedback experienced on a real vessel, such as the sensation of motion or the feel of the wind and waves;
* ***simulation fidelity*** - the level of realism in simulation may vary, and some simulators may not fully replicate all aspects of real-world maritime operations;
* ***technology dependency -*** simulators are dependent on technology, and technical issues or malfunctions can disrupt training sessions;
* ***human element simulation*** - simulating human factors, such as crew communication and decision-making, may be challenging and not always fully realistic;
* ***limited experience with uncommon scenarios*** - simulators may have limitations in replicating extremely rare or unconventional scenarios that could be encountered in real-world maritime operations;
* ***maintenance and upkeep -*** simulators require regular maintenance, updates, and technical support to ensure they remain effective and up-to-date.

Despite these weaknesses, ongoing advancements in technology are continually addressing many of these challenges, making maritime simulators increasingly sophisticated and valuable tools for training and skill development in the maritime industry.

The simulator instructors have an important role in developing the competences of students being the person that creates training scenarios on the simulator, establishes the learning objectives to be acquired, the minimal requirements and the assessment criteria.

***3.2 E-learning Platforms***

According to STCW Code, Section B-I/5 is take into the consideration and the training of seafarers by distance learning and e-learning. With the proliferation of online education, e-learning platforms have gained traction in the maritime sector.

Globally, online distance education has grown exponentially in recent years and has become an important part of higher education.

Information Technology (IT) based education currently includes a number of core distinctions between various forms of distance learning including e-Learning, online or Internet based learning, Web based, Cloud based and blended learning [1].

Today, seafarers would be able to access online education anytime anywhere due to the improved on board accessibility to the Internet. This will allow learning to be pursued anytime via information retrieval from an online distance education classroom. Cloud helps students develop high order thinking skills, allows them to integrate formal and informal learning, fosters experimentation, curiosity and creativity [2].

1. **Competency-Based Training**

Competency-based training has emerged as an effective approach in maritime education. A good method of learning is by doing. Because the competence is a person's ability to practice the knowledge acquired over time, the education principle „learn to practice – practice to learn” is used in MET in order to acquire the necessary skills for integration to the labor market.

The value of simulators are internationally recognised as follow: for 5 days (40 hours) as equal to 10 seagoing days, 10 days of simulator instruction equates to 30 seagoing days and 15 days or 120 hours equals 60 ocean days [3]

Simulators are better able to test people's memory without exposing ships and their crews to human error. The simulators also have the ability to test language comprehension skills, confidence, leadership, emergency response, risk management, navigation and communications.

In the case of traditional time-based models, the instructional method is done using mostly textbooks and standards, while in competency-based learning, the instructional method is done based on the learners.

In the traditional model, educational planning is based on an infrequent feedback loop, while in competency-based learning, it is based on a continuous feedback loop. In the traditional method interventions and personalization are generic and sporadic compared to the competency-based method.

1. **Case Studies**

***5.1 Collaborative Partnerships***

In order to meet the dynamic needs of the stakeholders including students, industry and society, in parallel with the changing professional realities of the modern world from the maritime education sector, 5 institutions (Romanian Naval Academy, T.C. Piri Reis Universitesi – Turkey, Nikola Yonkov Vaptsarov Naval Academy – Bulgaria, Akademia Marynarki Wojennej -Poland and Lietuvos aukstoji jureivystes mokykla - Lithuania) have come together under the Erasmus+ Programme – Cooperation partnerships in vocational and education training within the project “Maritime Simulators and Training Facilities Network for Enhancing the Exchange of Good Practices and Digital Learnings-(MARS-NET acronim) to develop a harmonized framework for teaching and research practices within the European Maritime Training and Education system.

The project promote the knowledge transfer between the European Union regions, seeking to build a knowledge “bridge” between the Black Sea and Baltic Sea in areas of education and training relying on academic expertise exchange in learning by simulation methods, with an emphasis on valuing the regional potential partners for education and research, using jointly the simulator facilities and digital learning resources.

The project offer an inter-regional joint framework in simulation learning system in maritime education, valuing the potential of developing skills, abilities and responsibilities of the graduates, to stimulate their insertion in the maritime international labor market.

Partners will share networking experience alongside the European space, increasing its competitiveness as international providers of MET. The project responds to the need of the labor market, to bring teaching methods into the new era of digitization, building new and innovative video tutorials and digital training materials for simulation facilities, to provide full access in time and space to educational processes.

***5.2 Technological Innovation***

The project is mainly focused on building an efficient and effective educational network among a large pool of partners, with regional soundness, to value the simulation facilities for adopting innovative teaching and learning practices, as a definitive step toward the digitization of maritime higher education system.

The following 5 wider intellectual outputs were defined under a quantitative perspective:

1. “Building the updated pool of competencies for maritime education to improve the value of simulating facilities in maritime education” where 10 course syllabuses were harmonized to value the simulation learning methods on hard and soft skills requirements, in order to align the MET curriculum to the newest STCW standards for preparing a virtual exchange program for students and teachers;
2. “Digital media tools to enhance the simulating teaching efficiency in maritime education” – the guidance framework were issued, together with the summary design of most 5 relevant courses in which simulation facilities and majorly used, further selected for a “digital” detailed preparation;
3. “Virtual digital campus for teachers, researchers and students” – a virtual network developed as a “virtual campus” were developed for sharing the didactic materials and the digital resources, for simulating learning environment courses and classes;
4. “Joint scientific research partnership for building a more efficient and effective teaching and learning environment based on simulation facilities” – technical solutions for integrating the simulator within an operational network were identified, where the students can freely access the training resources, even from onboard the ships;
5. “Virtual webinars tools to enhance the digitization of learning materials in Maritime Higher Education” – where an overall number of 250 students and 20 teachers will be virtually enrolled in digital classes, to support the developing of the digital content materials.

The network will allow the students participation on distance, for simulation learning system, on the following:

* + Ship Handling and Manoeuvring (Navigation simulator)
  + Navigational Watchkeeping (Navigation simulator)
  + Radar Navigation (Navigation simulator)
  + Engine Room Watchkeeping (Engine Room Simulator)
  + Cargo handling (Cargo handling Simulator).

The new innovative approach of the MARS-NET project lies in the uniqueness of this educational network, aiming at the harmonization of teaching practices, valuing the modern facilities of simulators on the basis of digitalization adoption in the maritime education and training, building an international network of learning and teaching resources.

On the other perspective, considering the great potential offered by the new educational technologies and facilities, the project is aiming the bring the teaching methods in the new era of digitization, building new and innovative video tutorials and digital materials for teaching session on simulating facilities, to offer full access in time and space to the education processes, in case of the maritime students, using blending learning methods and the digital tools for enhancing the independence and autonomy of the students carrying out the learning process during the cadetship onboard the ships.

***5.3 Partners simulators***

**A.** ***The Romanian Naval Academy*** uses for Ship handling and Manoeuvering the Wartsila simulator Navi-Trainer Professional 6000. This simulator consists of a Server (Domain Controller), two instructor stations, a Navi-Trainer Model station, 11 navigation points and a briefing room , where a number of 11 ships can be simulated simultaneously on different types of consoles, in different locations of the complex (a main compartment with a panoramic projection screen with a 240° opening, an intermediate compartment with a panoramic projection screen with a 120° opening , three compartments with 90° opening projection screens and 6 virtual consoles).

**B.** ***The Polish Naval Academy*** uses for Navigational Watchkeeping the Wartsila simulator Navi-Trainer Professional 5000.

Currently, the simulator team consists of the following six main components:

* ***Main bridge:*** equipped with 7 visualization channels with the possibility of configuring the angle in the horizontal plane. The main element of the bridge is a desktop equipped with 5 modules responsible for individual devices (WECDIS, RADAR, satellite system receivers, direction finder). Additionally, touch panels for individual navigation devices are placed on the desktop;
* ***Three bridges dedicated to the ships of the Polish Navy:*** configuration includes a desktop with navigation devices and a weapons panel, as well as 3 visualization channels. 2 bridges have a channel based on monitors and one on multimedia projectors;
* ***Individual training stations:*** consists of 8 training stations equipped with 2 main modules.

These are the CONNING panel and WECDIS/RADAR. Additionally, an instructor's station and 2 multimedia projectors were installed in this room.

**C.** ***The Piri Reis University*** uses for Engine Room Watchkeeping the Wartsila simulator. The engine room full mission simulator is equipped with consoles and panels to cover all operations managed from a ship's engine room. In the engine room full duty simulator classroom, all operations managed from a ship's engine room can be controlled via 10 computers. In the classroom, training on teamwork in the engine room can be given.

In the engine room simulator individual classroom with a capacity of 24 people, each computer can operate as a different engine room and engine room operations can be managed individually.

**D.** ***The Lithuanian Maritime Academy*** uses for Liquid Cargo Simulator the Wartsila simulator LCHS 5000 TechSim 9 (Liquid Cargo Handling Simulator) designed to train, evaluate, and certify tanker crew members and terminal operating personnel, as well as personnel responsible for the safe handling of liquid bulk cargo.

The LCHS 5000 TechSim 9 simulator offers an exact and detailed copy of the systems of the ships, of the terminals as well as their component elements.

* the goods handling facility;
* cargo pump control panel;
* monitoring the download/upload rate;
* load control system;
* ballast installation;
* the deck washing and fire extinguishing installation;
* gas detection system;
* goods heating installation;
* the tank washing/cleaning system;
* inert gas system.

**E.** **The Bulgarian Naval Academy** uses for both navigation and engine room operations the Wärtsilä simulators. Wärtsilä NTPRO Bridge simulator is a simulator that allows the integration of navigation and engine room simulators for realistic and comprehensive training of ship operations. The Techsim simulator by Wärtsilä is a simulator that mimics the functioning of different technological systems and equipment on vessels, such as the propulsion plant, electric power plant, auxiliary systems and machinery, alarm and safety systems, and liquid cargoes.

1. **Challenges and Solutions**

The innovative solution of this project is related to the simulations facilities valorization - so far, there is no technical solution to instruct the students online on this special courses that use the simulators even courses are compulsory subjects for cadets, according to STCW.

The partners will make available not only a singular type of simulation scenarios, but a wider range of tutorials will be available to the students, using different types of simulators from one partner to another, on a common integrated network, more comprehensive than singular solutions.

The integration of maritime simulators can enhance the overall training experience and provide a more realistic environment for maritime professionals.

Here are some common software and hardware solutions used for integrating maritime simulators:

1. **Software Solutions**:
2. ***Middleware Platforms***

A middleware platform is a software layer that serves as an intermediary between different software applications or components, facilitating communication and data exchange between them. Middleware is essentially software that "sits in the middle" to enable seamless interaction between diverse systems, applications, or services. It plays a crucial role in achieving interoperability, scalability, and flexibility in complex software architectures.

Middleware solutions act as a bridge between different simulators, facilitating communication and data exchange. They enable interoperability by standardizing communication protocols and data formats.

In the context of maritime simulation or any other distributed simulation environment, a middleware platform would act as a bridge between various simulation components, allowing them to exchange information in a standardized and efficient manner.

1. ***Simulation Frameworks***

Frameworks provide a set of tools and libraries for developing and integrating simulation components. They allow for the creation of custom simulation scenarios and can support the connection of various simulator types.

A simulation framework for connecting maritime simulators is a software infrastructure that provides tools, libraries, and standards for the development, integration, and execution of maritime simulations. These frameworks are designed to facilitate the connection and coordination of different simulation components, allowing for a more comprehensive and realistic training environment. Simulation frameworks typically include features that support interoperability, communication, and data exchange between various maritime simulators.

1. ***Common Data Model (CDM):***

A Common Data Model (CDM) for connecting maritime simulators refers to a standardized representation of data that is shared among different simulation components and systems within a maritime simulation environment. The primary goal of a CDM is to establish a common language or format for expressing simulation-related information, ensuring consistency and interoperability across various simulators and simulation modules.

CDMs are often developed collaboratively within the simulation community. Industry stakeholders, simulation developers, and standardization organizations may contribute to the creation and refinement of a CDM.

***Examples of Maritime CDMs***:

* + SISO CDM for Maritime Simulations (SISO CDMMaritime):

The Simulation Interoperability Standards Organization (SISO) has developed a CDM specifically tailored for maritime simulations. It addresses the representation of entities, platforms, and environmental conditions in maritime environments.

* + NATO Naval Warfare Data Model (NWDM):

The NWDM is designed to support the exchange of tactical data in naval warfare simulations. While not exclusively a CDM, it includes data representations relevant to maritime simulation.

When implementing a CDM for maritime simulators, it's crucial to consider the specific requirements of the simulation scenarios, the types of simulators involved, and the overall training objectives. Adherence to established standards can enhance the effectiveness of a Common Data Model in fostering interoperability within the maritime simulation domain.

CDM is a standardized data format that ensures consistency in the representation and exchange of simulation data. Implementing a common data model can facilitate interoperability between simulators.

1. ***Distributed Interactive Simulation (DIS):***

Distributed Interactive Simulation (DIS) is a standard protocol used for connecting and interoperating among various simulation systems, including maritime simulators. DIS was originally developed for military simulations but has been widely adopted across different domains, including maritime training, to enable communication and coordination between distributed simulation entities.

In the maritime training context, DIS can be utilized to connect maritime simulators, allowing for realistic and collaborative training scenarios involving different vessels, ports, and environmental conditions. When implementing DIS in maritime simulations, it's important to ensure compatibility with industry standards and guidelines to achieve effective interoperability.

DIS is a protocol standard for real-time communication between multiple simulators. It is commonly used in military simulation, but its principles can be adapted for maritime simulation integration.

1. ***Custom APIs (Application Programming Interfaces):***

Some simulator manufacturers provide APIs that allow developers to create custom interfaces and connections between different simulators. This approach is effective when simulators have open and well-documented interfaces.

**II. Hardware Solutions:**

1. ***Simulator Communication Hardware:***

Dedicated hardware devices may be used to establish physical connections between simulators. These devices facilitate the transmission of data between different simulator systems.

1. ***Network Infrastructure:***

High-speed and reliable network infrastructure is essential for connecting simulators. Ethernet-based networks, including local area networks (LANs) and wide area networks (WANs), are commonly used for simulator integration.

1. **Synchronization Systems:**

Synchronization systems ensure that different simulators operate in unison, maintaining consistency in the simulation environment. This can include synchronization of time, weather conditions, and vessel positions.

1. ***Hardware-In-The-Loop (HIL) Systems:***

HIL systems integrate physical hardware components, such as engine room controls or navigation panels, into the simulation environment. This enhances realism and provides a more immersive training experience.

1. ***Virtualization Technologies:***

Virtualization allows multiple simulators to run on a single hardware platform, reducing the need for dedicated hardware for each simulator. This approach can optimize resource utilization and streamline integration.

**III. Integrated Simulation Platforms:**

1. ***Commercial Off-The-Shelf (COTS) Solutions:***

Some companies offer integrated simulation platforms that combine multiple simulation modules into a cohesive training environment. These platforms are designed to simplify the integration process.

1. ***Cloud-Based Solutions:***

Cloud-based platforms enable distributed simulation scenarios where different simulators run in separate locations but are connected through the cloud. This can enhance accessibility and collaboration.

1. ***Unified Simulation Control Systems:***

Unified control systems provide a centralized interface for managing and controlling different simulators. They allow instructors to orchestrate complex training scenarios involving multiple simulation modules.

When considering integration solutions, it's important to work closely with simulator manufacturers, technology providers, and system integrators to ensure compatibility and adherence to industry standards. Additionally, considering the specific needs of your training program will help determine the most suitable integration approach.

# **7. Wärtsilä Cloud simulation**

Since the maritime simulators used by the partners are all produced by Wartsila, the solution for their integration comes directly from the manufacturer

Wärtsilä Cloud Simulation enables marine schools and training centres to offer their usual training services on-demand to a larger group of trainees without any additional hardware.

It is a Software as a Service (SaaS) solution, allowing the user to have remote access to application software deployed in the cloud, databases, and content (exercises and scenarios). Meaning, it makes training materials and scenarios produced for your local classroom application accessible worldwide using PCs (personal computers), laptops, tablets, or any mobile devices. Instructors also have remote access to the application all the time, making managing the courses more flexible.

Considering its inherent conveniences – in terms of cost, reach, and effectiveness – cloud simulation technology is poised to create new opportunities for training providers globally. Expand your offerings to ride the wave with the next-generation blended learning solutions.

***Key benefits***

* **Up to date:** Always get the latest available version of the simulator.
* **Costs effective:** No hardware administration, upgrades or maintenance costs.
* **Smart support:**Qualified technical support engineers make sure your solution is up and running when you schedule it.
* **Accessibility:**Available online, anytime, and anywhere in the world, via the Internet.
* **Compatibility:** It is the same simulator software as your classroom installation, just a different delivery method.
* **Enhanced remote collaboration:** Invite instructors from anywhere in the world to deliver the training.
* **Flexible configuration:**Use the number of workplaces you need.
* **Adaptability:**Try it before you buy it and pay for the use only.
* **Easy content management:** Build courses, assign them to students, and accurately track the results — all seamlessly.

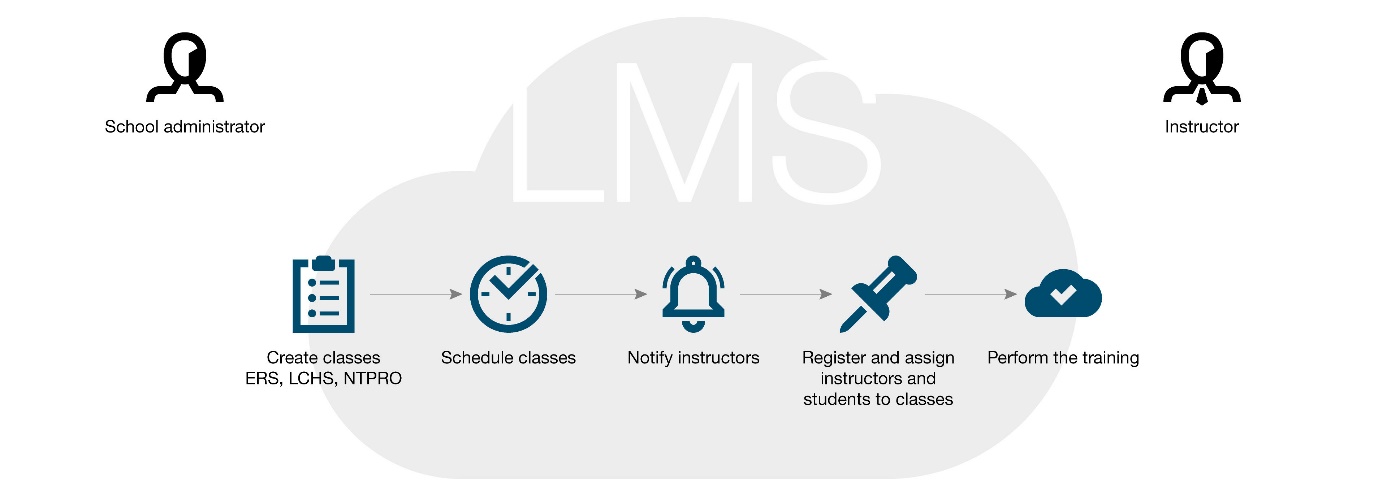


Fig. 1. Cloud simulation

## Wärtsilä Cloud Simulation on Ocean Learning Platform

The strategic partnership with OTG (Ocean Technologies Group) provides industry stakeholders in maritime learning – shipping companies, maritime training providers, crewing agencies, and seafarers – with a unique opportunity to be connected on a single end-to-end learning journey. The solution combines on-demand digital training and assessment, virtual and simulation events via cloud-based solutions, in-person learning experiences at maritime training centres or aboard ships – all training and certification options via one platform.

***Key benefits***

Quick and cost-effective access to online simulated environments, equipment and scenarios enable you to:

* Upskill existing crew.
* Uncomplicate pre-employment assessment.
* Risk-free pre-mission planning.
* Respond quickly to immediate training and certification requirements.
* Reach global cohorts easily.
* Collaborate with experts worldwide.

This solution offers tangible benefits for ship operators, crewing agencies and maritime training institutes.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **BENEFICIARY** | **BENEFITS** | | | |
| **Flexibility** | **Cost-efficient** | **New**  **possibilities** | **Open-market collaborations** |
| **Ship operators and owners** | Access cloud-based high-quality simulations for training, mission planning and assessments – anytime and anywhere. | Simpler and more efficient end-to-end training programs reduce downtime, the need for travel to physical simulators, and the associated costs. | Makes it possible to bring advanced training and assessment closer to the flow of work. Greater assurance from need-based assessments. | Directly connects you to your providers, suppliers, and the international community of instructors. |
| **Institutes and agencies** | Not bound by the number of physical installations and can scale with demand. | What you spend directly relates to what you use/sell--no big upfront payment needed. | Connect seamlessly into off-METI workflows, adding value and creating new streams. All data in one place for performance analytics and insight. | With global reach, you are no longer only reliant on your local market. Customers are everywhere, and you can now serve them from wherever you are. |

Wärtsilä and Ocean Technologies Group partnered to deliver transformational learning solutions to improve safety and efficiency at sea.



Fig. 2. Wärtsilä and Ocean Learning Platform

This partnership offers the following benefits for:

***Learners***

* Flexible remote learning from anywhere and anytime
* Better support pre and post sessions
* Easier tracking of achievements

***Instructors***

* Flexible remote working from anywhere and anytime
* Ability to assemble cohorts easily
* Ability to design richer and more effective learning pathways

***Administrators***

* Single workflow
* Assemble cohorts regardless of geography
* Clearer overview of records and performance metrics

For the final solutions identified about connecting the simulators in cloud or about the digital resources posted and available on virtual campus, the IAMU and BSAMI members will be informed. Also IMO – International Maritime Organization will be notify in this respect, promoting the valuable results of the virtual campus implementation in respect of soft and hard skills development for maritime cadets, in compliance with STCW requirements, but adapted to the new distance interaction new approach due to the pandemic trends.

1. **Future Trends**

Bringing into the attention the research potential of the simulators, the partners will continue to develop studies involving high profiled companies interested in HR studies, risk management studies, environmental studies, software development and so on.

In this terms, the project could bring an additional value to the project, grounding the basis for common research division of the partners in research by simulating techniques. Another sustainable result will consist of the increases in number of Erasmus+ student and staff mobilities among the partners and to economic agents.

**9. Conclusions**

Taking in account the new and more effective syllabus in the maritime related occupations, the partnership between this five institutions foresees an increase of the interest from the maritime industry's side to assist financially the development of new MET facilities.

This scientific research emphasizes the importance of research and innovation in shaping the maritime education and training sector. By embracing technological advancements, competency-based approaches, and collaborative partnerships, the MET can ensure a skilled and competent workforce, promoting safety, efficiency, and sustainability in theglobal maritime domain.

In conclusion, the integration of maritime simulators across this five institutions, facilitated by Wärtsilä's Cloud Simulation and Ocean Learning Platform, marks a pivotal advancement in maritime education and training. The adoption of cloud-based connectivity not only streamlines the interoperability of simulators but also signifies a paradigm shift towards more flexible, scalable, and collaborative learning environments. By harnessing the power of cloud simulation and the Ocean Learning Platform, these institutions are poised to transcend traditional boundaries, enabling seamless data exchange, real-time collaboration, and access to a wealth of maritime scenarios.

This solution not only enhances the overall efficiency of training programs but also positions the maritime industry at the forefront of cutting-edge technological innovation. As we sail into the future, this connectivity initiative serves as a beacon for the transformative potential of cloud-based solutions in shaping a more interconnected and proficient maritime workforce.

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