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SOLENT UNIVERSITY

# Euro-ZA: Capacity Building in the Field of Maritime Education
# Final Facilities Report
# Work Package 2.3

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## Abstract

The training and education of Merchant Navy Cadets and Officers has a strong practical element. The remoteness, risk and complexity in the workplace itself necessitates a range of training facilities to emulate and simulate the workplace for the trainee or student. Different institutions internationally have developed their facilities for courses offered and compliance with the national training requirements, international training requirements and specialist local industry requirements. This has resulted in a diverse approach to the development of facilities across different institutions. This document outlines the facilities at each of the partners within the project and identifies common trends and baselines by means of categorising facilities and recording the distribution of facilities within categories. This supports the overall project aims of identifying the curriculum, pedagogical approaches and facilities required to support different disciplines in the industry, draw conclusions and make recommendations for development for the partners. Based on both the commonality of facilities between partners and requirements set out in international legislation, a series of recommendations for required facilities are therefore given. The enhancement of facilities during the project is discussed, with a narrative explaining the change in the context of facilities use due to the global Covid-19 Pandemic.

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# Contents

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# Nomenclature

| | |
|---|---|
| ARPA | Automatic Radar Plotting Aid |
| CPUT | Cape Peninsula University of Technology |
| DP | Dynamic Positioning |
| DUT | Durban University of Technology |
| ECDIS | Electronic Chart Display Information Systems |
| FMS | Full Mission Simulator |
| FRB | Fast Rescue Boat |
| FRC | Fast Rescue Craft |
| GMDSS | Global Maritime Distress and Safety System |
| HUET | Helicopter Underwater Escape Trainer |
| HV | High Voltage |
| HW | Hochschule Wismar University of Applied Sciences Technology Business and Design |
| IMO | International Maritime Organisation |
| NMU | Nelson Mandela University |
| METO | Marine Electro-Technical Officer |
| OPITO | Offshore Petroleum Industry Training Organisation |
| PELB | Partially Enclosed Lifeboat |
| SAMMON | Simulation Augmented Manoeuvring Design & Monitoring |
| STCW | Standards of Training, Certification and Watchkeeping |
| SU | Solent University, Southampton |
| SAMK | Satakunta University of Applied Sciences |
| TEMPSC | Totally Enclosed Motor Propelled Survival Craft |
| VR | Virtual Reality |
| VTIS | Vessel Traffic Information Services |

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# Introduction

## Project Overview

The Euro-ZA: Capacity Building in the Field of Maritime Education project seeks to support seafarer education and training in South Africa by developing international employment opportunities for South African seafarers, along with employment opportunities on the growing South African ship register. The intention of the program is to ensure that these seafarers are able to operate at the highest international standard, opening opportunities for them to work for a range of global employers. The international collaborative nature of the project allows the individual partners to learn from the varied approaches, complementary programmes and experiences of the other partners, resulting in the identification of areas of best practice and the enhancement of the curriculum.

The European partners also benefit from an improvement in their international reach and the opportunity to build networks for further cooperation, staff exchange and research. Furthermore, the European partners benefit from new insights and perspectives in maritime training and education, enabling them to ensure that their graduates have better multicultural awareness in the international maritime industry.

In support of this overall objective, the project seeks to examine and enhance seafarer training through three key elements: curriculum; pedagogy and facilities.

The Curriculum Evaluation section of the project aims to provide an analysis of the curriculums of the partners, highlighting areas of strength and weakness, allowing each partner to develop their curriculum to ensure that there is a recognised curriculum between the partners that also meets international standards.

The Pedagogical Process element aims to assess the relative strengths and weaknesses of individual methodologies in seafarer training and education, including but not limited to traditional classroom teaching, E-teaching and learning, blended teaching and learning, workplace teaching and learning and simulation-based teaching and learning.

The Resource and Facilities element aims to create a proposal for the required facilities (and therefore budget) for standardisation between the partners. This report details the facilities at each of the partners and assesses the elements of commonality, therefore also highlighting areas for investment for the partners.

## Work Package

The purpose of this report is to document the facilities for Maritime Education at each partners' campus in accordance with the Facilities and Resources work package and identify trends in facilities between partners of the Euro-ZA project.

The training and education of Merchant Navy Cadets and Officers has a strong practical element which is often embedded with theoretical elements as part of a training scheme or educational course. As seafarers necessarily operate in a remote location, often in limited numbers, the scope and feasibility of "on the job" training and assessment is severely limited. This is made even more difficult by the high-risk elements of working at sea and the complexity (in terms of both breadth and depth) of normal and ab-normal operations for which a seafarer must be competent.

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This complex scenario means that maritime training and education institutions must utilise a range of specialist facilities on a spectrum from general engineering laboratories and workshops to detailed “state-of-the-art” simulated environments for training. Statistics (Manuel, et al., 2019) show that whilst face-to-face teaching is still the primary method of teaching in maritime training and education establishments, simulation is the second most common teaching method. However, it is important to note that facilities by themselves do not create an effective training environment or foster effective training and education unless they are used to promote the best industry and pedagogical practices.

International requirements for the use of facilities and simulation are outlined by the International Maritime Organisation (IMO) through the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978 (as amended in 1995 and 2010) (International Maritime Organisation, 1978), often referred to as STCW or the STCW code. The code itself is divided into two sections, A and B. Part A contains mandatory standards, whilst part B provide non-mandatory guidelines. Mandatory standards for navigation simulation (for bridges, radar and ARPA) are given in a very broad form in section A-I/12 for individual signatory countries to interpret and use as a basis. Guidelines for the use of simulation equipment are given in Section B-I/12, which itself is linked to the required standards adopted by IMO for maritime equipment and systems, ensuring that simulation facilities achieve a suitable level of fidelity and realism. Facilities for engineering courses or engine simulation are not described.

For the assessment of competence, the STCW code contains a series of tables (for each job role) in Chapter 2 prescribing how competence for various roles can be demonstrated. These are in very general terms, but include “*approved simulator training, where appropriate*”; “*approved laboratory equipment training*”; “*approved ECDIS simulator training*”; “*assessment of evidence obtained from simulation*” and through “*approved workshop skills training*”. These requirements of STCW are interpreted and applied in each member state of IMO by individual national Governments, aided in some circumstances by IMO Model Courses for guidance. As such, although guided and in accordance with STCW, there is scope for interpretation of requirements in some instances, so the type of facility and the complexity of the equipment vary subtly between different member states.

There are also specialist areas of maritime training and education, such as naval architecture and the need to provide training and support for local specialised industries, which also mean that different maritime training and education institutions also have specialist facilities to complement the STCW based requirements, which are sometimes used in addition to the STCW facilities in the training and education of seafarers leading to Certificates of Competency (CoC). The result of this is that there is a diverse range of facilities at different institutions, along with varying approaches to their use in pedagogy, albeit all aimed at providing an education in accordance with STCW requirements at a broad international standard.

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## Scope, Aims and Objectives

The intention of the facilities work package of the project is to assess and report on the range of facilities and resources required to meet the aims and objectives for the 21st century international curriculum and pedagogical practises within the consortium. On that basis, the aims and objectives of the Facilities and Resources Work Package is to:

> • *Establish requirements and expectations within the consortium considering the global leaders in maritime education and training*
>
> • *Identify (gap analysis) the teaching and learning equipment to meet the aims and objectives for the 21st century curriculum* and pedagogical practises *within the consortium*
>
> • *Implementation of recommendations*
>
> • *The acquisition, by means of a cost benefit analysis, of the required facilities and resources to give effect to the aims and objectives*

With the initial aim of determining the desired requirements by considering the global leaders in maritime education and training there is a predisposition in the report towards analysis and comparison of the facilities of the European and South African partners. This report does not seek to pass a judgement on the social, political and economic factors which have a bearing on the facilities of the three South African Universities. The effective use of the facilities and the effectiveness of the pedagogy within the various facilities is considered in other aspects of the overall project and is reported elsewhere. In support of the Work Package aims and objectives, this report therefore aims to:

- Categorise facilities at each of the partners to allow a comparison and gap analysis
- Identify the commonality of facilities between partners
- Display the distribution of facilities in order to see gaps in resources that could be addressed by acquisition as part of the project.

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## Provision by Partners

Maritime education and training for seafarers can be defined in three categories aligned with formal qualifications within STCW:

- Navigation or Deck Officer – responsible for the safe navigation of the vessel and cargo operations.

- Marine Engineering Officer – responsible for the safe operation and maintenance of the ship's systems including main propulsion machinery, auxiliary plants and electrical systems. auxiliary machinery and hotel systems.

- Marine Electro-Technical Officer – responsible for the safe operation and maintenance of the ship's electrical and electronic systems. This is a comparatively new discipline, having previously been part of the Marine Engineering Officer's responsibilities. Despite the different disciplines, there are some areas of overlap between the two areas resulting in common resource requirements.

Whilst there is some overlap of general and specialist facilities for all three discipline areas, each one requires certain specialist facilities to enable and enhance learning. Different providers offer training and education in either all of these discipline areas or selected areas based on their specialisms. As such, providers may not have or require a complete set of facilities, further making a direct comparison between partners difficult. Table 1 shows the disciplines delivered (or intended to be delivered by the end or following the end of the project) by each of the partner institutions that lead to a formal Certificate of Competence in accordance with IMO and STCW requirements.

| Partner | Navigation or Deck Officer | Marine Engineering Officer | Marine Electro-Technical Officer |
|---|---|---|---|
| CPUT | | | |
| DUT | | | |
| HM | | | |
| NMU | | | |
| SAMK | | | |
| SU | | | |

*Table 1: Partners' Subject Area Provision*

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# Methodology

To gather the required data site visits were undertaken as part of the project group meetings at; Hochschule Wismar (February 2019); Satakunta University of Applied Sciences (February 2019); Solent University (June 2019); Cape Peninsular University of Technology (November 2019); Durban University of Technology (November 2019) and Nelson Mandela University (November 2019). In addition, partners completed an individual questionnaire (shown in Appendix One: Questionnaire with the results tabulated in Appendices Two to Eleven).

To break down the data into comparable areas, a set of ten categories were defined based on discipline area and resource type:

I. Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based)
II. Bridge/Navigation/Deck Operations Simulators (Desktop based)
III. Miscellaneous Interactive Simulators and Resources
IV. Engineering Simulation (Non-Desktop based)
V. Engineering Simulation (Desktop based)
VI. Engineering Workshops/Laboratories
VII. Automation and Electrical Engineering Laboratories
VIII. Survival Training
IX. Classrooms and Other Specialist Spaces
X. Miscellaneous Other Facilities

These were further divided in 88 subcategories based on the raw data collected through the questionnaires. The raw data was analysed and allocated to each category, with a matrix developed for each category of equipment showing the declared facilities and resources at each partner institution. From this a total index was determined to show how often each type of facility occurred across all partners, based on a cumulative number of occurrences of each facility type. Facilities with a total of two or above (and hence operated by a third of the partners) were determined to be “International Baseline” resources. Facilities with a total of three or above (and hence operated by at least half of the partners) were determined to be “Common” resources, whilst a final category of “Common European” was developed to show any facilities that were common across all three European partners.

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# Classification of Facilities

The facilities and resources have been divided into nine categories for ease of comparison. Whilst they are important to the overall student experience, generic education facilities, such as multi-purpose libraries and study spaces, general purpose IT resource rooms, general student support or catering and welfare facilities have not been included.

## Bridge/Navigation/Deck Operations Simulators

For the purposes of this report, these are defined as equipment designed to replicate the bridge or set of instruments on a bridge in an integrated way mirroring that of a vessel so that they can be used in accordance with STCW requirements for the training and assessment of deck officers.

These are typically seen in two configurations, non-desktop based and desk-top based. Non-desktop based simulators are (for the purposes of this report) defined as permanent, fixed installations that physically simulate the environment of the bridge or wheelhouse allowing the user to interact with a range of integrated controls and systems to operate, navigate and manoeuvre a vessel through a complex range of scenarios. These are typically powered by a network of specialist Personal Computers (PCs) due to the large computational resource required. These are often referred to as Full-Mission Simulators.

Desktop based simulators are (for the purpose of this report) defined as a PC based simulator running from a single desktop PC, often to multiple screens, but simulating operations and procedures rather than the working environment. These are often used for courses relating to the specific use of radar or for training and familiarisation prior to moving on full-mission simulators. These are sometimes referred to as part-task trainers, however some part-task trainers are also built into a “bridge” environment.

Given the specialist nature of the equipment there are relatively few manufacturers with international reach. The most common in Europe are TRANSAS (part of Wärtsilä), Kongsberg and Rheinmetall Electronics.

## Miscellaneous Interactive Simulators and Resources

These are defined as specialist simulation facilities, software packages or databases which form part of training programmes and courses but which do not relate directly to the manoeuvring or navigation operation of the vessel and are in addition to but not required for STCW compliance. Examples may be specific simulation packages for bespoke non-navigation operations such as firefighting, or access to databases to support research.

## Engineering Simulation

As with navigation simulation equipment, these are typically seen in two configurations, non-desktop based and desk-top based.

For the purpose of this report, non-desktop based simulators and equipment are defined as permanent, fixed installations that physically simulate the Machinery Control Room or provide a virtual machinery space that the user can interact with. As with the equivalent in navigation, they replicate the machinery control room, machinery control panels, machinery space or set of instruments in an integrated way mirroring that of a vessel. Unlike the navigation elements, there is no formal requirement for their use as per STCW requirement (other than for HV Training), so there

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is a greater range of local uses for bespoke training. These are often referred to as Full-Mission Simulators.

Desktop based engineering simulators are (for the purpose of this report) defined as a PC based simulator running from a single desktop PC, often to multiple screens, but simulating operations and procedures rather than the working environment. As with the navigation equivalent, these are often used for courses relating to the familiarisation prior to moving on full-mission simulators. These are sometimes referred to as part-task trainers.

### Engineering Workshops/Laboratories

These are defined as teaching spaces available for use by maritime engineering students as part of their course of study. Some facilities may be shared with other programmes. These facilities typically include mechanical engineering equipment such as lathes and milling machines, welding bays and engines with ancillary systems.

### Automation and Electrical Engineering Laboratories

These are defined as specialist facilities available for use by maritime engineering students, although they may be shared with other programmes. They will include laboratories for subject areas such as control systems, automation, robotics and electronics.

### Survival and Emergency Training

These are defined as specialist facilities used for STCW specified sea survival and emergency training. These include pools for wet drills and fire-fighting facilities. These are aligned to the requirements of Chapter A-VI within STCW and the Offshore Petroleum Industry Training Organisation (OPITO) industry body requirements for courses supporting safety in the oil and gas industry. For the purposes of this paper this excludes GMDSS equipment which is often integrated into bridge simulators.

### Classrooms and other Specialist Spaces

These are defined as classrooms or specialist areas with specific features related to maritime training and education. Examples may include dedicated training rooms, lecture theatres designed for webinars for remote students who could be at sea and/or off campus, and specialist facilities such as training vessels.

### Miscellaneous Other Facilities

These are defined as specialist facilities with specific features related to maritime training and education, but outside of the scope of compulsory education and training and therefore more aligned to niche or specialist areas of individual providers.

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# Individual Partner's Facilities.

The following tables show a matrix of facilities at each of the partner institutions. Full details of facilities declared by the partners are provided in the appendices. For the purpose of clarity this includes facilities purchased and under construction as of July 2020 as it is acknowledged that once complete these facilities will enhance the provision of respective institutions. The data also only includes "in house" facilities as opposed to facilities sub-contracted to private providers. To simplify the matrix to a reasonable level the facilities have been considered at a generic level as opposed to specific specialist aspects. More details such as the number of workstations or number of individual facilities are given the in the appendices but not considered here as this relates more to managing student cohort size rather than having the capability to deliver training and education. In some circumstances, the syllabus and courses run by consortium members differ, and so facilities that are not relevant to specific institutions are indicated by a diagonal line.

## Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based)

All the European partner institutions have at least one 360-degree full mission simulator, and at least three similar simulators but with a limited field of vision. These are enhanced with facilities for Dynamic Positioning and the simulation of Azipod systems. All facilities are capable of use for ECDIS, Radar, and ARPA training to meet minimum requirements of STCW courses. Hochschule Wismar has additional facilities for the planning, execution and training of complex manoeuvres by Fast-Time Simulation technology. The software used is called Simulation Augmented Manoeuvring Design & Monitoring (SAMMON), developed by the research institute Institut für Innovative Schiffs-Simulation und Maritime Systeme (ISSIMS) of HW.

| **Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based)** | **CPUT** | **DUT** | **NMU** | **HW** | **SAMK** | **SU** | **Total** |
|---|---|---|---|---|---|---|---|
| 360 Degree FMS with Azipod/DP Capability | | | | | | | 3 |
| Below 360 Degree FMS | | | | | | | 3 |
| Part-Task Trainer | | | | | | | 1 |
| VTIS Simulator | | | | | | | 2 |

*Table 2: Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based) Matrix*

Baseline Resources: 360 Full Mission simulator with Azipod and DP capability; additional Full Mission Simulators with a field of vision below 360 degrees, VTIS Simulators.

Common Resources: 360 Full Mission simulator with Azipod and DP capability; additional Full Mission Simulators with a field of vision below 360 degrees.

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## Bridge/Navigation/Deck Operations Simulators (Desktop based)

Within the European partners desktop simulators are used for a wide range of applications related to both STCW and specialist applications. A common theme between the partners is the use of desktop simulators for GMDSS. Two partners have liquid cargo simulation facilities. Hochschule Wismar (HW) has a specialist Safety and Security trainer which enhances training for non-navigation operations related to security and response to a range of emergencies such as fire.

| **Bridge/Navigation/Deck Operations Simulators (Desktop based)** | **CPUT** | **DUT** | **NMU** | **HW** | **SAMK** | **SU** | **Total** |
|---|---|---|---|---|---|---|---|
| Desk-top Based Bridge Simulation | ■ | ■ | ⁄ | | ■ | ■ | 4 |
| Fast Time Manoeuvring Simulator | | | ⁄ | ■ | | | 1 |
| GMDSS Simulator | ■ | ■ | ⁄ | ■ | ■ | ■ | 5 |
| Liquid Cargo Simulator | | | ⁄ | ■ | | ■ | 2 |
| Safety and Security Trainer | | | ⁄ | ■ | | | 1 |
| Tanker Simulator | | | ⁄ | ■ | | | 1 |

*Table 3: Bridge/Navigation/Deck Operations Simulators (Desktop based) Matrix*

Baseline Resources: Desk-top based bridge simulation (note that HW have part-task trainers as non-desktop simulators), Liquid Cargo Simulators and GMDSS simulators.

Common Resources: Desk-top based bridge simulation and GMDSS simulators

## Miscellaneous Interactive Simulators and Resources

There is a greater variance in the facilities in this category. Two partners have access to the Regs4Ships databases which contain details of IMO conventions and codes. Two partners have software relating to specialist aspects of ship stability prediction and analysis.

| **Miscellaneous Interactive Simulators and Resources** | **CPUT** | **DUT** | **NMU** | **HW** | **SAMK** | **SU** | **Total** |
|---|---|---|---|---|---|---|---|
| On and Offshore Crane Simulator | | | | | | ■ | 1 |
| Compass Room | | | ⁄ | | | ■ | 1 |
| Fast Time Simulation Optimisation | | | ⁄ | ■ | | | 1 |
| Navigation Laboratory | | | ⁄ | ■ | | | 1 |
| Regs4Ships Database | | | | | ■ | ■ | 2 |
| Roll Resonance Trainer | | | ⁄ | ■ | | | 1 |
| Ship Trial Data Analysis | | | ⁄ | ■ | | | 1 |
| SPOS Route Optimisation Software | | | ⁄ | | ■ | | 1 |
| Stability Analysis Software | | | | | ■ | ■ | 2 |

*Table 4: Miscellaneous Interactive Simulators and Resources Matrix*

Baseline Resources: Regs4Ships database access; stability analysis software.

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## Engineering Simulation (Non-Desktop based)

As a facility with no prescriptive use within STCW other than HV training, there is a greater variation between partners. All European partners have facilities for HV training as this is required under STCW. All partners have some form of full mission simulator, either as a PC based simulator with simulations of controls or physical controls with the ability to adjust the background models. All European partners have some form of virtual engine room.

| Engineering Simulation (Non-Desktop based) | CPUT | DUT | NMU | HW | SAMK | SU | Frequency |
|---|---|---|---|---|---|---|---|
| 3D Virtual Machinery Space | | | | ■ | ■ | ■ | 3 |
| Emergency Switchboard Trainer | | | | | ■ | ■ | 2 |
| Engine Fault Diagnosis Equipment | | | | ■ | | | 1 |
| Full Mission Engine Room Simulator with Multiple Engine Models | | | | ■ | ■ | ■ | 3 |
| HV Training Breakers | | | ■ | | ■ | ■ | 3 |
| Supply System Simulation | | | | ■ | | ■ | 2 |

*Table 5: Engineering Simulation (Non-Desktop based) Matrix*

Baseline Resources: Emergency switchboard trainer; 3D virtual machinery space; full mission engine room simulator with multiple engine models; high voltage training breakers, supply system simulation.

Common Resources: Full mission engine room simulator with multiple engine models; 3D virtual machinery space; high voltage training breakers..

## Engineering Simulation (Desktop based)

There is a strong commonality between the European partners. Desk-top based simulation is based around the use of training stations to simulate aspects of engine room operations and align to the full mission simulator. This allows more effective use of the limited resource of a full mission simulator. Partners have between 12 and 24 workstations available with multiple monitors to extend displays and improve usability.

| Engineering Simulation (Desktop based) | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Desktop Training Stations | | | ■ | ■ | ■ | ■ | 4 |
| Naval Architecture Analysis Laboratory | | | | | | ■ | 1 |

*Table 6: Engineering Simulation (Desktop based) Matrix*

Baseline Resources: Desk-top training stations.

Common Resources: Desk-top training stations.

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## Engineering Workshops/Laboratories

Engineering workshops and associated laboratories are perhaps the most generic of facilities in that they are also relevant to traditional engineering courses at many Higher Education Institutions, so they are likely to contain a range of facilities with mixed relevance to marine engineering. However, different national administrations set standards for education and training which start with common hand-skills and engineering knowledge which sets some generic requirements. There is a common theme of running engines and non-running engines (for students to disassemble and reassemble), general engineering workshops

| Engineering Workshops/Laboratories | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Advanced Manufacturing Laboratory | | | | | | ■ | 1 |
| Applied Mechanics Laboratory | | | | | | ■ | 1 |
| Auxiliary Machinery Systems | | | | ■ | ■ | ■ | 3 |
| Composite Materials Laboratory | | | | | | ■ | 1 |
| Control Systems Laboratory | | | | ■ | | ■ | 2 |
| Engine Control Room for Remote Running | | | | ■ | | | 1 |
| Engineering Seminar Room | | | | ■ | | | 1 |
| Engineering Systems Demonstration Equipment | ■ | | | | | | 1 |
| Engineering Workshop | | | ■ | ■ | ■ | ■ | 4 |
| Fluid Dynamics Laboratory | | | ■ | | | ■ | 2 |
| Fuel Laboratory | | | | ■ | | | 1 |
| Materials Testing Laboratory | | | ■ | | | ■ | 2 |
| Non-Running Engine | | | ■ | ■ | ■ | ■ | 4 |
| Power Generation Laboratory | | | | ■ | | | 1 |
| Refrigeration Laboratory | | | ■ | ■ | | | 2 |
| Running Engine with Dynamometer/Genset | | | | ■ | ■ | ■ | 3 |
| Small Vessel Engineering Workshop | | | | | | ■ | 1 |
| Steam Laboratory | | | | ■ | ■ | | 2 |
| Steam Turbine Test Stand | | | | ■ | | | 1 |
| Thermodynamics Laboratory | | | | | | ■ | 1 |

*Table 7: Engineering Workshops/Laboratories Matrix*

Baseline Resources: Auxiliary machinery systems equipment; control systems laboratory; engineering workshop; fluid dynamics laboratory; materials testing laboratory; non-running engines; running engines with genset or dynamometer; refrigeration laboratory; steam laboratory or teaching equipment.

Common Resources: Auxiliary machinery systems equipment; engineering workshop; non-running engines; running engines with genset or dynamometer.

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## Automation, Electronic and Electrical Engineering Laboratories

The 2010 Manila amendments (International Maritime Organisation, 2010) to STCW brought about new training requirements and a specialist certificate of competence for Marine Electro-Technical Officers, allowing a greater specialisation in this area. The specialist nature of maritime automation and electrical system (and the resulting requirements of A-III/6 of STCW Code outlining requirements for Electro-Technical Officers) means that facilities for this area are more specialised than general engineering facilities. In particular, the teaching of skills needed to finding faults and problem solving in specialist marine electro-technical equipment linking instrumentation and control systems requires supporting facilities. As such, it can be seen that the European partners have practical facilities (in the form of Martine Electro-Technical laboratories or similar electrical laboratories and workstations) to support this specialised area, with supporting facilities to assist with more specialist areas outside of STCW but relevant to modern engineering. The relatively recent development of the METO route to qualification has perhaps resulted in a greater focus on specialist equipment in some areas compared to the traditional marine engineering syllabus.

| **Automation and Electrical Engineering Laboratories** | CPUT | DUT | NMU | HW | SAMK | SU | **Total** |
|---|---|---|---|---|---|---|---|
| Automation and Control Workstations | | | ■ | ■ | | | 2 |
| Electrical Engineering Laboratory | | | | ■ | | ■ | 2 |
| Electrical Engineering Workstation | | | | ■ | | ■ | 2 |
| Marine Electro-technical Laboratory | | | ■ | | ■ | ■ | 3 |
| Robotics Laboratory | | | | | | ■ | 1 |

*Table 8: Automation, Electronic and Electrical Engineering Laboratories Matrix*

Baseline Resources: Automation and control workstations; electrical engineering laboratory; electrical engineering workstation; marine electro-technical laboratory.

Common Resources: Marine electro-technical laboratory.

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## Survival and Emergency Training

Requirements for facilities for survival and emergency training are outlined in STCW. However, an industry body, OPITO, also provides accreditation for courses specifically for those in the oil and gas industry. As such, facilities may exceed STCW requirements. These combined requirements result in all institutions offering these courses operating a survival or swimming pool, lifeboat facilities and fast rescue craft. Within the maritime industry a number of private organisations hold approval to provide survival-based training. For some Higher Education providers, it may be preferable to out-source survival and emergency training to these private providers. Facilities not owned or operated by partner institutions but used as part of the seafarer training and education are not included here.

| Survival Training | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Davit Launched Life raft | ■ | | ■ | | | | 2 |
| Enclosed lifeboats | ■ | | | | ■ | ■ | 3 |
| Escape System | | | | | | ■ | 1 |
| Fast Rescue Craft | ■ | | | | ■ | ■ | 3 |
| Fire Fighting Training Unit | | | ■ | | | ■ | 2 |
| Heliraft | ■ | | | | | | 1 |
| High Water Entry Point | ■ | | | | | ■ | 2 |
| HUET | ■ | | | | | | 1 |
| Immersion Suits | ■ | | ■ | | ■ | ■ | 4 |
| Medical First Aid Training Facility | ■ | | ■ | | | ■ | 3 |
| Open Lifeboats | ■ | | | | ■ | | 2 |
| Partially Enclosed Lifeboat | | | | | | ■ | 1 |
| RIB | | | | | | ■ | 1 |
| Specialist Survival Meeting Space | ■ | | | | | | 1 |
| Specialist Survival Teaching Space | ■ | | | | | ■ | 2 |
| Survival Pool | ■ | | ■ | | ■ | ■ | 4 |
| Throw-over Life raft | ■ | | | | | | 1 |

*Table 9: Survival and Emergency Training Matrix*

Baseline Resources: Davit launched life raft; enclosed lifeboats; fast rescue craft; fire-fighting training units; high water entry point; immersion suits; medical first aid training facility; open lifeboats; specialist survival teaching space; survival pool.

Common Resources: Enclosed lifeboats; fast rescue craft; immersion suits; medical first aid training facility; survival pool.

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## Classrooms and Other Specialist Spaces

Whilst STCW and industry body requirements may specify minimum standards, localised courses for specific specialisms or University facilities and teaching policies may require and enable additional specialist teaching spaces. There is more diversity in the range and type of facility but the majority of partners have specialist classrooms dedicated to navigation and engineering courses in support of other specialist facilities.

| Classrooms and Other Specialist Spaces | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Conference Rooms | | | | ■ | | ■ | 2 |
| Deck Workshops | | | ◢ | | ■ | ■ | 2 |
| Language Laboratory | | | | ■ | | | 1 |
| Maretek Software | ■ | | | | | | 1 |
| Specialist Lecture Theatre | | | ■ | | ■ | | 2 |
| Specialist Library Facilities | ■ | | ■ | ■ | | ■ | 4 |
| Specialist Marine Engineering Classrooms | ■ | ◢ | ■ | ■ | ■ | ■ | 5 |
| Specialist Maritime PC Rooms | | ■ | | ■ | | ■ | 3 |
| Specialist Navigation Classrooms | ■ | | ◢ | ■ | ■ | ■ | 4 |
| Webcast Facilities | | | ■ | | ■ | ■ | 3 |

*Table 10: Classrooms and Other Specialist Spaces Matrix*

Baseline Resources: Conference rooms; deck workshops; specialist lecture theatre; specialist library facilities; specialist marine engineering classrooms; specialist maritime pc rooms; specialist navigation classrooms; webcast facilities.

Common Resources: Specialist library facilities; specialist marine engineering classrooms; specialist maritime pc rooms; specialist navigation classrooms; webcast facilities.

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## Miscellaneous Other Facilities

Whilst difficult to draw any specific trends from, different partners have specialisms supported by unique facilities. As can be seen there is no commonality between partners and these facilities aside from stability tanks.

| Miscellaneous Other Facilities | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Child Care | | | | | | | 1 |
| Large Scale Cargo Handling Facility with Derricks | | | | | | | 1 |
| Manned Model Centre | | | | | | | 1 |
| Sauna | | | | | | | 1 |
| Towing Tank and Wavemaker | | | | | | | 1 |
| Training Vessel | | | | | | | 1 |
| Stability Tank | | | | | | | 2 |

*Table 11: Miscellaneous Other Facilities Matrix*

Baseline Resources: Stability tank

Common Resources: None

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## Baseline and Commonality Analysis

Using the total scores previously noted tables of facilities with a total of 2 or above (indicating that they are in place in more than one provider) can be derived. This gives both a summary of baseline facilities and an indication of commonality. Data for these is shown in Tables 12 to 21.

| Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based) | Total |
|---|---|
| 360 Degree FMS with Azipod/DP Capability | 3 |
| Below 360 Degree FMS | 3 |
| VTIS Simulator | 2 |

*Table 12: Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based) Baseline and Total Data*

| Bridge/Navigation/Deck Operations Simulators (Desktop based) | Total |
|---|---|
| GMDSS Simulator | 5 |
| Desk-top Based Bridge Simulation | 4 |
| Liquid Cargo Simulator | 2 |

*Table 13: Bridge/Navigation/Deck Operations Simulators (Desktop based) Baseline and Total Data*

| Miscellaneous Interactive Simulators and Resources | Total |
|---|---|
| Regs4Ships Database | 2 |
| Stability Analysis Software | 2 |

*Table 14: Miscellaneous Interactive Simulators and Resources Baseline and Total Data*

| Engineering Simulation (Non-Desktop based) | Total |
|---|---|
| 3D Virtual Machinery Space | 3 |
| Full Mission Engine Room Simulator with Multiple Engine Models | 3 |
| HV Training Breakers | 3 |
| Emergency Switchboard Trainer | 2 |
| Supply System Simulation | 2 |

*Table 15: Engineering Simulation (Non-Desktop based) Baseline and Total Data*

| Engineering Simulation (Desktop based) | Total |
|---|---|
| Desktop Training Stations | 4 |

*Table 16: Engineering Simulation (Desktop based) Baseline and Total Data*

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| Engineering Workshops/Laboratories | Total |
|---|---|
| Engineering Workshop | 4 |
| Non-Running Engine | 4 |
| Auxiliary Machinery Systems | 3 |
| Running Engine with Dynamometer/Genset | 3 |
| Control Systems Laboratory | 2 |
| Fluid Dynamics Laboratory | 2 |
| Materials Testing Laboratory | 2 |
| Refrigeration Laboratory | 2 |
| Steam Laboratory | 2 |

*Table 17: Engineering Workshops/Laboratories Baseline and Total Data*

| Automation and Electrical Engineering Laboratories | Total |
|---|---|
| Marine Electro-technical Laboratory | 3 |
| Automation and Control Workstations | 2 |
| Electrical Engineering Laboratory | 2 |
| Electrical Engineering Workstation | 2 |

*Table 18: Automation and Electrical Engineering Laboratories Baseline and Total Data*

| Survival Training | Total |
|---|---|
| Immersion Suits | 4 |
| Survival Pool | 4 |
| Enclosed lifeboats | 3 |
| Fast Rescue Craft | 3 |
| Medical First Aid Training Facility | 3 |
| Davit Launched Life raft | 2 |
| Fire Fighting Training Unit | 2 |
| High Water Entry Point | 2 |
| Open Lifeboats | 2 |
| Specialist Survival Teaching Space | 2 |

*Table 19: Survival and Emergency Training Baseline and Total Data*

| Classrooms and Other Specialist Spaces | Total |
|---|---|
| Specialist Marine Engineering Classrooms | 5 |
| Specialist Library Facilities | 4 |
| Specialist Navigation Classrooms | 4 |
| Specialist Maritime PC Rooms | 3 |
| Webcast Facilities | 3 |
| Conference Rooms | 2 |
| Deck Workshops | 2 |
| Specialist Lecture Theatre | 2 |

*Table 20: Classrooms and Other Specialist Spaces Baseline and Total Data*

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| Miscellaneous Other Facilities | Total |
|---|---|
| Stability Tank | 2 |

*Table 21: Miscellaneous Baseline and Total Data*

This data is also presented in Table 22 to Table 31. The previous definitions of "Baseline" and "Common" are shown. In order to show any geographical bias in the values a third category, "Common European" has also been included. This shows any facility or resource that is common to all three European partners. This is intended to make distribution clearer to understand and show any geographic bias. This is because historically, proportionally higher levels of investment in infrastructure in European universities will skew the distribution of facilities towards the European partners and not necessarily show an accurate distribution between all partner institutions.

| Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based) | Baseline | Common | Common European |
|---|---|---|---|
| 360 Degree FMS with Azipod/DP Capability | | | |
| Below 360 Degree FMS | | | |
| Part-Task Trainer | | | |
| VTIS Simulator | | | |

*Table 22: Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based) Commonality*

| Bridge/Navigation/Deck Operations Simulators (Desktop based) | Baseline | Common | Common European |
|---|---|---|---|
| Desk-top Based Bridge Simulation | | | |
| Fast Time Manoeuvring Simulator | | | |
| GMDSS Simulator | | | |
| Liquid Cargo Simulator | | | |
| Safety and Security Trainer | | | |
| Tanker Simulator | | | |

*Table 23: Bridge/Navigation/Deck Operations Simulators (Desktop based) Commonality*

| Miscellaneous Interactive Simulators and Resources | Baseline | Common | Common European |
|---|---|---|---|
| On and Offshore Crane Simulator | | | |
| Compass Room | | | |
| Fast Time Simulation Optimisation | | | |
| Navigation Laboratory | | | |
| Regs4Ships Database | | | |
| Roll Resonance Trainer | | | |
| Ship Trial Data Analysis | | | |
| SPOS Route Optimisation Software | | | |
| Stability Analysis Software | | | |

*Table 24: Miscellaneous Interactive Simulators and Resources Commonality*

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| Engineering Simulation (Non-Desktop based) | Baseline | Common | Common European |
|---|---|---|---|
| 3D Virtual Machinery Space) | ■ | ■ | ■ |
| Emergency Switchboard Trainer | ■ | | |
| Engine Fault Diagnosis Equipment | | | |
| Full Mission Engine Room Simulator with Multiple Engine Models | ■ | ■ | ■ |
| HV Training Breakers | ■ | ■ | |
| Supply System Simulation | ■ | | |

*Table 25: Engineering Simulation (Non-Desktop based) Commonality*

| Engineering Simulation (Desktop based) | Baseline | Common | Common European |
|---|---|---|---|
| Desktop Training Stations | ■ | ■ | ■ |
| Naval Architecture Analysis Laboratory | | | |

*Table 26: Engineering Simulation (Desktop based) Commonality*

| Engineering Workshops/Laboratories | Baseline | Common | Common European |
|---|---|---|---|
| Advanced Manufacturing Laboratory | | | |
| Applied Mechanics Laboratory | | | |
| Auxiliary Machinery Systems | ■ | ■ | ■ |
| Composite Materials Laboratory | | | |
| Control Systems Laboratory | ■ | | |
| Engine Control Room for Remote Running | | | |
| Engineering Seminar Room | | | |
| Engineering Systems Demonstration Equipment | | | |
| Engineering Workshop | ■ | ■ | ■ |
| Fluid Dynamics Laboratory | ■ | | |
| Fuel Laboratory | | | |
| Materials Testing Laboratory | ■ | | |
| Non-Running Engine | ■ | ■ | ■ |
| Power Generation Laboratory | | | |
| Refrigeration Laboratory | ■ | | |
| Running Engine with Dynamometer/Genset | ■ | ■ | ■ |
| Small Vessel Engineering Workshop | | | |
| Steam Laboratory | ■ | | |
| Steam Turbine Test Stand | | | |
| Thermodynamics Laboratory | | | |

*Table 27: Engineering Workshops/Laboratories Commonality*

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| Automation and Electrical Engineering Laboratories | Baseline | Common | Common European |
|---|---|---|---|
| Automation and Control Workstations | ■ | | |
| Electrical Engineering Laboratory | ■ | | |
| Electrical Engineering Workstation | ■ | | |
| Marine Electro-technical Laboratory | ■ | ■ | |
| Robotics Laboratory | | | |

*Table 28: Automation and Electrical Engineering Laboratories Commonality*

| Survival Training | Baseline | Common | Common European |
|---|---|---|---|
| Davit Launched Life raft | ■ | | |
| Enclosed lifeboats | ■ | ■ | |
| Escape System | | | |
| Fast Rescue Craft | ■ | ■ | |
| Fire Fighting Training Unit | ■ | | |
| Heliraft | | | |
| High Water Entry Point | ■ | | |
| HUET | | | |
| Immersion Suits | ■ | ■ | |
| Medical First Aid Training Facility | ■ | ■ | |
| Open Lifeboats | ■ | | |
| Partially Enclosed Lifeboat | | | |
| RIB | | | |
| Specialist Survival Meeting Space | | | |
| Specialist Survival Teaching Space | ■ | | |
| Survival Pool | ■ | ■ | |
| Throw-over Life raft | | | |

*Table 29: Survival Training Commonality*

| Classrooms and Other Specialist Spaces | Baseline | Common | Common European |
|---|---|---|---|
| Conference Rooms | ■ | | |
| Deck Workshops | ■ | | |
| Language Laboratory | | | |
| Maretek Software | | | |
| Specialist Lecture Theatre | ■ | | |
| Specialist Library Facilities | ■ | ■ | |
| Specialist Marine Engineering Classrooms | ■ | ■ | ■ |
| Specialist Maritime PC Rooms | ■ | ■ | |
| Specialist Navigation Classrooms | ■ | ■ | ■ |
| Webcast Facilities | ■ | ■ | |

*Table 30: Classrooms and Other Specialist Spaces Commonality*

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| Miscellaneous Other Facilities | Baseline | Common | Common European |
|---|---|---|---|
| Child Care | | | |
| Large Scale Cargo Handling Facility with Derricks | | | |
| Manned Model Centre | | | |
| Sauna | | | |
| Towing Tank and Wavemaker | | | |
| Training Vessel | | | |
| Stability Tank | | | |

*Table 31: Miscellaneous Other Facilities Commonality*

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# Recommendations

As described previously, the requirements for facilities laid out in legislation is in a very general form and is interpreted on a national basis by individual administrations. As such there is likely to be a variation between partners' facilities, especially considering the variation in provision in terms of subject disciplines. Making broad recommendations is therefore difficult, however more specific recommendations can be made for each discipline area based on regulatory requirements and the "common" category in the preceding section. It should be noted that partners' budgets and resources have not been included as a factor in making these recommendations to ensure that these are a broad set of recommendations for all partners.

## Recommendation 1:

For Navigation or Deck Officer training, a 360 Degree Full Mission Simulator with Azipod and DP Capability and further Full Mission Simulators with a reduced arc of vision are required supported with desktop simulation (with suitable software for ECDIS type specific training). A form of navigation simulation is required for ARPA training, where STCW does specifically stipulate that competence is assessed via "*approved radar simulator and ARPA simulator training*".

## Recommendation 2:

Based on a similar rationale to the navigation simulation facilities, GMDSS simulation facilities are required to meet the requirements laid out in Table A-IV/2 of STCW that requires approved equipment, a GMDSS communication simulator (where appropriate) or radiocommunication laboratory equipment.

## Recommendation 3:

For Marine Engineering Officer training there is not a specific or legislated requirement for simulation, however, it can be used as a method of demonstrating competence for several aspects of watch-keeping. Based on the partner's facilities, a 3D virtual machinery space and a Full Mission Simulator for the machinery control room are required (again supported by desktop simulators).

## Recommendation 4:

To facilitate the teaching and assessment of High Voltage courses that are required to meet the requirements of Tables A-III/2 and A-III/6 in STCW HV Circuit breakers are required.

## Recommendation 5:

To meet the requirements of workshop training facilities, institutions require Auxiliary Machinery Systems, a general engineering workshop, non-running and running engines with marine electro-technical laboratories that support the education and assessment of Marine Electro-Technical Officers as well as Marine Engineering Officers.

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### Recommendation 6:

Survival training requirements are set out in more detail in sections A-VI/1 to A-VI/4 of STCW which explicitly and implicitly state required facilities for emergency, occupational safety, medical care and survival functions. It should be noted that some partners use third-party providers, and as such the equipment is not represented in the tables in the preceding section. However, sections A-VI/1 to A-VI/4 of STCW require the minimum general equipment to demonstrate competence:

- Lifejackets
- Immersion suits
- A survival pool with a high entry point
- Life rafts
- Survival craft (with launch and recovery systems)
- Location devices
- Varying fire extinguishers and methods of extinguishing different types of fires
- Breathing apparatus
- Fast rescue craft
- Fire detection equipment
- First aid equipment

For the delivery of courses accredited by OPTIO additional equipment will be required beyond those listed above. These requirements are set by OPTIO who should be consulted for specific facility requirements based on individual provider's circumstances

### Recommendation 7:

For other facilities, using the "common" category as the marker for requirements, partners should have specialist library facilities (which existing partners have as either separate facilities or areas within general libraries), specialist classrooms for all disciplines, specialist maritime PC facilities and webcast facilities.

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## Conclusions to the Initial Study and Recommendations

It can be seen from the facilities matrices that there are a diverse range of facilities between the partner institutions of the consortium. This may be driven by historic specialisms in teaching, investment patterns by governments, research areas and specialist requirements for local industries and conditions. STCW requirements drive a commonality in some areas of operational simulation and engineering facilities despite different national interpretations of STCW and teaching models.

Physical simulation of the working environment for navigators and engineers is widespread across the partners, with full mission simulators for both disciplines supported by desktop and part-task trainers across all European partners, as is specific equipment to comply with STCW requirements for GMDSS training. For navigators, access is also required to stability analysis packages, whilst all disciplines need access to a database of rules and regulations.

The data shows that engineering workshop facilities are wide-spread across partner, institutions as these are an inherent requirement for STCW training. These are widely supported by specialist maritime auxiliary systems, running and non-running engines. A range of further specialist engineering facilities support these but there is a wide variation in the specific type of facility between partner institutions. Specific minimum equipment lists will be set by national administrations as part of course approval processes and will probably inform and account for the variation in these. Some partner institutions offer additional, non-maritime engineering courses which may account for additional supporting facilities that are used across a range of courses.

For survival and emergency training in accordance with STCW, access to a survival pool (with a high-water entry point and life rafts), enclosed and open lifeboats and fast rescue craft is required and hence can be seen to influence a number of categories at the baseline level. As only on-campus facilities (and not those out-sourced to private suppliers) were considered, there is perhaps an element of under-reporting in this category. Centres servicing the oil and gas industry with OPITO accreditation will require further facilities in accordance with OPITO standards.

To support specialist facilities, dedicated classrooms are commonplace for navigation and engineering, supported by specialist library facilities, webcast facilities and maritime-focused IT rooms. These webcast facilities will perhaps become more important in the post-Covid 19 economy globally. Other miscellaneous specialist facilities differ greatly between partners, with a stability tank the only baseline level facility operated by two partner institutions.

Based on the survey of facilities at partner institutions and the requirements of the STCW code, partner institutions in South Africa should consider using the facilities funding available in the project to procure equipment to reach the recommended facilities in the previous section as a minimum.

The very best facilities are, however, of limited use without the supporting infrastructure, right staff and pedagogical approaches to using them effectively. This is not covered within the scope of this report but nonetheless should be considered as part of a wider purchasing and development strategy for upgrading facilities in accordance with the overall project.

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## Resulting Facilities Development

Following the Facilities study (and during the progress of the project as information became available) the South African partner institutions enhanced their provision through the acquisition of additional facilities, in accordance with the recommendations of the study and the developing matrices showing the distribution of facilities across the institutions. The development of these facilities against the recommendations is shown below in Table 32 (with "Y" indicating yes, "N" indicating no and "P" indicating partial achievement). It should be noted that not all recommendations are relevant to all partner institutions, and as detailed below, the global Covid-19 Pandemic changed the context of facility use during the project. It is therefore not a criticism of any partner institution which has not complied with all the recommendations.

| **Recommendation and Partner** | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| CPUT | N | Y | Y | N | N | P | Y |
| DUT | N | Y | | | | | N |
| NMU | | | Y | Y | Y | P | N |
| HW | Y | Y | Y | N | Y | | Y |
| SAMK | Y | Y | Y | Y | Y | N | Y |
| SU | Y | Y | Y | Y | Y | Y | Y |

*Table 32: Recommendation Implementation*

It should be noted that in the study of the existing facilities and the resulting recommendations, budget considerations were not included. It is therefore not anticipated that each partner institution would meet all of the recommendations, as resources would not permit this, but use the recommendations as a broad tool to guide the development of their facilities.

During the course of the project, and after the initial phase where existing facilities were determined and placed into the matrices, the world was hit by the Covid-19 Pandemic. Understandably this resulted in both temporary and permanent changes to pedagogical processes and practices, especially where national regulations placed restrictions on attending campuses and the use of specialist facilities (Pokhrel & Chetri, 2021). To mitigate against this, many Universities in different countries, teaching different disciplines developed methods of virtual access to facilities, including the use of simulation and specialist software access via online and cloud computing. As such, some of the recommendations and resulting facility development should be considered in the context of changing methods of students engaging with facilities. Furthermore, the mains power infrastructure in South Africa does not appear robust enough to meet all demands, therefore, supporting infrastructure to minimise the impact of power-cuts, or load shedding, on equipment has been important in providing reliable access to facilities, both on campus and virtually.

The following tables show (in purple) the additional facilities purchased and commissioned as part of the project. Facilities marked with an asterisk (*) are pre-existing but have been upgraded as part of this project. Facilities upgrades of European institutions during this project, but not funded by this project, and facilities supporting learning but not student facing, such as additional staff laptops and office hardware are not shown but are discussed in the conclusion section.

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## Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based)

| Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based) | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| 360 Degree FMS with Azipod/DP Capability | | | | | | | 3 |
| Below 360 Degree FMS | | | | | | | 3 |
| Part-Task Trainer | | | | | | | 1 |
| VTIS Simulator | | | | | | | 2 |

*Table 33: Final Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based) Matrix*

During the project, no non-desktop simulation facilities have been added to the partner institutions' facilities. However, as described later, desktop facilities have been developed significantly in comparison to the start of the project.

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## Bridge/Navigation/Deck Operations Simulators (Desktop based)

| Bridge/Navigation/Deck Operations Simulators (Desktop based) | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Desk-top Based Bridge Simulation | * | | | | | | 4 |
| Fast Time Manoeuvring Simulator | | | | | | | 2 |
| GMDSS Simulator | | | | | | | 5 |
| Liquid Cargo Simulator | | | | | | | 2 |
| Safety and Security Trainer | | | | | | | 1 |
| Tanker Simulator | | | | | | | 1 |

*Table 34: Final Bridge/Navigation/Deck Operations Simulators (Desktop based) Matrix*

Both CPUT and DUT have been able to develop their Desktop based simulation capacity. CPUT have enhanced their facilities with Class A desktop simulation, therein increasing the number of vessels available and the geographic regions covered. CPUT have been able to enhance the control systems used, along with Ship-to-Ship and Ship-to-Shore communication systems within the simulation software. DUT have purchased six standalone licenses for SAMMON fast time manoeuvring software, along with a training package from the vendor.

## Miscellaneous Interactive Simulators and Resources

| Miscellaneous Interactive Simulators and Resources | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| On and Offshore Crane Simulator | | | | | | | 1 |
| Compass Room | | | | | | | 1 |
| Fast Time Simulation Optimisation | | | | | | | 1 |
| Navigation Laboratory | | | | | | | 1 |
| Regs4Ships Database | | | | | | | 2 |
| Roll Resonance Trainer | | | | | | | 1 |
| Ship Trial Data Analysis | | | | | | | 1 |
| SPOS Route Optimisation Software | | | | | | | 1 |
| Stability Analysis Software | | | | | | | 2 |

*Table 35: Final Miscellaneous Interactive Simulators and Resources Matrix*

During the project, no miscellaneous interactive simulators and resources have been added to the partner institutions' facilities. However, as described later, some additional facilities aimed at enhancing online elements have been developed.

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## Engineering Simulation (Non-Desktop based)

| Engineering Simulation (Non-Desktop based) | CPUT | DUT | NMU | HW | SAMK | SU | Frequency |
|---|---|---|---|---|---|---|---|
| 3D Virtual Machinery Space | | | | | | | 3 |
| Emergency Switchboard Trainer | | | | | | | 2 |
| Engine Fault Diagnosis Equipment | | | | | | | 1 |
| Full Mission Engine Room Simulator with Multiple Engine Models | | | | | | | 3 |
| HV Training Breakers | | | | | | | 3 |
| Supply System Simulation | | | | | | | 2 |

*Table 36: Final Engineering Simulation (Non-Desktop based) Matrix*

During the project, no non-desktop engineering simulation facilities have been added to the partner institutions' facilities. However, as described later, desktop engineering facilities have been developed significantly in comparison to the start of the project.

## Engineering Simulation (Desktop based)

| Engineering Simulation (Desktop based) | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Desktop Training Stations | | | * | | | | 5 |
| Naval Architecture Analysis Laboratory | | | | | | | 1 |

*Table 37: Final Engineering Simulation (Desktop based) Matrix*

CPUT have installed a Wartsila Desk-top engine room simulator, allowing the simulation of dual-fuel diesel electric vessels and a container ship. Likewise, NMU have upgraded their facilities with a 15-station Wartsila Desk-top engine room simulator, with an additional instructor station. This has a distributed power-system to mitigate against power-cuts and load shedding.

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## Engineering Workshops/Laboratories

| Engineering Workshops/Laboratories | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Advanced Manufacturing Laboratory | | | | | | | 1 |
| Applied Mechanics Laboratory | | | | | | | 1 |
| Auxiliary Machinery Systems | | | | | | | 3 |
| Composite Materials Laboratory | | | | | | | 1 |
| Control Systems Laboratory | | | | | | | 2 |
| Engine Control Room for Remote Running | | | | | | | 1 |
| Engineering Seminar Room | | | | | | | 1 |
| Engineering Systems Demonstration Equipment | | | | | | | 2 |
| Engineering Workshop | | | | | | | 4 |
| Fluid Dynamics Laboratory | | | | | | | 2 |
| Fuel Laboratory | | | | | | | 1 |
| Materials Testing Laboratory | | | | | | | 2 |
| Non-Running Engine | | | | | | | 4 |
| Power Generation Laboratory | | | | | | | 1 |
| Refrigeration Laboratory | | | | | | | 2 |
| Running Engine with Dynamometer/Genset | | | | | | | 3 |
| Small Vessel Engineering Workshop | | | | | | | 1 |
| Steam Laboratory | | | | | | | 2 |
| Steam Turbine Test Stand | | | | | | | 1 |
| Thermodynamics Laboratory | | | | | | | 1 |

*Table 38: Final Engineering Workshops/Laboratories Matrix*

NMU have enhanced their existing engineering teaching facilities with teaching equipment covering motor starter systems, electrical motor testing equipment and the associated tooling and maintenance equipment.

## Automation, Electronic and Electrical Engineering Laboratories

| Automation and Electrical Engineering Laboratories | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Automation and Control Workstations | | | | | | | 2 |
| Electrical Engineering Laboratory | | | | | | | 2 |
| Electrical Engineering Workstation | | | | | | | 2 |
| Marine Electro-technical Laboratory | | | | | | | 3 |
| Robotics Laboratory | | | | | | | 1 |

*Table 39: Final Automation, Electronic and Electrical Engineering Laboratories Matrix*

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## Survival and Emergency Training

| Survival Training | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Davit Launched Life raft | ■ | | ■ | | | | 2 |
| Enclosed lifeboats | ■ | | | | ■ | ■ | 3 |
| Escape System | | | | | | ■ | 1 |
| Fast Rescue Craft | ■ | | | | ■ | ■ | 3 |
| Fire Fighting Training Unit | | | ■ | | | ■ | 2 |
| Heliraft | ■ | | | | | | 1 |
| High Water Entry Point | ■ | | | | | ■ | 2 |
| HUET | ■ | | | | | | 1 |
| Immersion Suits | ■ | | ■ | | ■ | ■ | 4 |
| Medical First Aid Training Facility | ■ | | ■ | | | ■ | 3 |
| Open Lifeboats | ■ | | | | ■ | | 2 |
| Partially Enclosed Lifeboat | | | | | | ■ | 1 |
| RIB | | | | | | ■ | 1 |
| Specialist Survival Meeting Space | ■ | | | | | | 1 |
| Specialist Survival Teaching Space | ■ | | | | | ■ | 2 |
| Survival Pool | ■ | | ■ | | ■ | ■ | 4 |
| Throw-over Life raft | ■ | | | | | | 1 |

*Table 40: Final Survival and Emergency Training Matrix*

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## Classrooms and Other Specialist Spaces

| Classrooms and Other Specialist Spaces | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Conference Rooms | | | | | | | 2 |
| Deck Workshops | | | | | | | 2 |
| Language Laboratory | | | | | | | 1 |
| Maretek Software | | | | | | | 1 |
| Specialist Lecture Theatre | | | | | | | 2 |
| Specialist Library Facilities | | | | | | | 4 |
| Specialist Marine Engineering Classrooms | | | | | | | 5 |
| Specialist Maritime PC Rooms | | | | | | | 3 |
| Specialist Navigation Classrooms | | | | | | | 4 |
| Webcast Facilities | | | | | | | 4 |

*Table 41: Final Classrooms and Other Specialist Spaces Matrix*

DUT have enhanced their facilities with a video conferencing videobar, enhancing communication between staff on campus and students working remotely.

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## Miscellaneous Other Facilities

| Miscellaneous Other Facilities | CPUT | DUT | NMU | HW | SAMK | SU | Total |
|---|---|---|---|---|---|---|---|
| Child Care | | | | | | | 1 |
| Large Scale Cargo Handling Facility with Derricks | | | | | | | 1 |
| Manned Model Centre | | | | | | | 1 |
| Sauna | | | | | | | 1 |
| Towing Tank and Wavemaker | | | | | | | 1 |
| Training Vessel | | | | | | | 1 |
| Stability Tank | | | | | | | 2 |

*Table 42: Final Miscellaneous Other Facilities Matrix*

## Additional Facilities

In addition to the categories above, the impact of the pandemic and the resulting changing landscape of Higher Education meant that there were some additional relevant purchases made by the partner institutions.

NMU purchased a high-performance laptop for more complex desktop modelling tasks, which allowed the demonstration of more complex software packages whilst working remotely and undertaking online teaching. In addition, a Microsoft Surface Pro was purchased for online lecturing, with the additional battery life used to mitigate against power-cuts and load shedding. To enable online marking and marking on electronic documents, a Wacom writing tablet was also purchased. To enable software with on-campus license requirements to be use for remote access teaching, a high-performance 48 CPU server with power back-up systems was purchased.

DUT purchased staff laptops and a colour laser printer to enable teaching using the SAMMON software.

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## Facility Development During the Project - Conclusion

The project has enabled the South African partner institutions to develop their maritime-focused teaching facilities. The facilities matrices show a diverse range of facilities across the consortium members, but they also show an enhanced parity of facilities. Whilst the distribution of facilities may be driven by historic specialisms, government investment, research income and local drivers, global requirements have been set by STCW code. These have not been permanently updated on an international basis to reflect differences in teaching and learning practice post-Covid, and therefore, there is an element of enhancing facilities that is dependent on further enhancing on-line training as well as traditional classroom training.

The pandemic has resulted in a greater need to consider online learning to maintain access to learning for students, with a high probability that online or distance learning will have a greater emphasis in the post-Covid world (International Maritime Organisation, 2020). Over the course of the project the global MET industry has therefore developed in a different direction to that of pre-2020, when the original study of the project members' facilities was undertaken. Whilst physical simulation of the working environment for navigators and engineers is widespread across the partners, with full mission simulators for both disciplines supported by desktop and part-task trainers across all European project members, this is not common across the South African partners institutions, who have a greater reliance on desk-top simulation. Given the impact of the pandemic and the rapid development of online simulation technology, it is understandable that a more sustainable path for future development may be through the use of cloud simulation and desk-top work where STCW and national regulations permit.

The impact of this is that the development of facilities during the project may not have aligned directly with all of the recommendations developed in the pre-Covid era, but they have developed in accordance with the demands of global changes in Maritime Education, Training and Development.

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# Appendix One: Questionnaire

**EURO-ZA Capacity building in the field of maritime education**

**Facilities – Outline Questionnaire**

The purpose of this document is to establish the current facilities at each of the providers, in order to determine a "baseline" of facilities suitable to meet training and education requirements.

Please give as much detail as possible in each of the areas, and add any additional information which you feel is relevant to the project. If I have left anything out please feel free to add it in!

| Bridge/Navigation Simulators (Non-Desktop based) |
|---|
| • |

| Bridge/Navigation/ECDIS Simulators (Desktop based) |
|---|
| • |

| Misc. Interactive |
|---|
| • |

| Engineering Simulation (Non-Desktop based) |
|---|
| • |

| Engineering Simulation (Desktop based) |
|---|
| • |

| Engineering Workshops |
|---|
| • |

| Survival Training |
|---|
| • |

| Class Room |
|---|
| • |

| Misc |
|---|
| • |

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# Appendix Two: Bridge/Navigation/Deck Operations Simulators (Non-Desktop Based)

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • One Full Mission Simulator with 360 degree projector based visual system (Manufacturer: Rheinmetall Electronics RME) with manoeuvring panels for Azipod/Dynamic Positioning/Voith/Waterjet control systems<br><br>• One Full Mission Simulator (RME) 270 degree wall to ceiling projection for manoeuvring simulation.<br><br>• Two RME Full Mission Simulators with 120 degree screen based viewing system by monitors for manoeuvring simulation.<br><br>• Two 120 degree RME part-task bridges.<br><br>• All of the Bridges are ready for integrated training carrying ECDIS, RADAR ARPA, track pilots and other elements like GMDSS, AIS.<br><br>• Six instructorless (ILT) part-task training stations with ECDIS, Radar / ARPA and conning screen and handle panel. | • One 360 degree visual TRANSAS Full Mission Simulator with DP training facilities and Azipod control.<br><br>• Four 180 degree visual TRANSAS simulator bridges (possibility of turning the picture so you see 360 degrees) with DP training facilities | • One Full Mission Simulator with 270 degree projector based visual system (Manufacturer: TRANSAS) with manoeuvring panels for Azipod/Dynamic Positioning.<br><br>• Two 360 degree TRANSAS Full Mission Simulators with manoeuvring panels for Azipod/Dynamic Positioning<br><br>• Three 270 degree TRANSAS Full Mission Simulators with manoeuvring panels for Azipod/Dynamic Positioning |

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| | | |
|---|---|---|
| • Fast Time Manoeuvring Simulation (SAMMON Planning, Monitoring and Conning modules) can be used on all bridges via W-Fi interface.<br><br>• Vessel Traffic Services Simulator with 9 VTIS operator's stations with 5 monitors each, and 3 instructor stations with exercise-control displays based on an ECDIS-type presentation. | | |

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|---|---|---|
| • None declared | • None declared | • None declared (do not run navigation courses) |

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# Appendix Three: Bridge/Navigation/Deck Operations Simulators (Desktop based)

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • Four Fast Time Manoeuvring Simulators (SAMMON – Simulation Augmented Manoeuvring Design & Monitoring)<br><br>• Safety and Security Trainer (Simulator, representing the full 3D Layout of a ship and equipment and functions for fighting fire, water inrush, pirate attacks, bomb search etc.), including one instructor stations, one bridge station (forming ship safety centre), 9 trainee stations Training stations consist of situation and action monitor (based on 10 interfaced PC workstations)<br><br>• Tanker simulator<br><br>• TRANSAS Liquid Cargo Handling simulator<br><br>• GMDSS-simulator with 8 training stations | • 10 PC workstations, each with three monitors.<br><br>• GMDSS simulator with 10 stations + 5 stations in bridges mentioned above | • 24 PC workstations, each with three monitors (dual Deck/Engine).<br><br>• GMDSS simulator with 24 stations and two examination suites.<br><br>• TRANSAS Liquid Cargo Handling simulator with four work stations (doubles up as VTIS simulation) |

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|---|---|---|
| • 8 bridge desktop simulators for Electronic Navigation Systems (ENS) operational and Management Courses (TRANSAS)<br><br>• 1 instructor station for bridge desktop simulator (TRANSAS)<br><br>• 7 GMDSS simulators with 1 GMDSS instructor station | • Instructor station (Navi-Trainer 5000, Transas Marine Ltd. 1993-2011)<br><br>• 6 PC working stations (Navi-Trainer 5000, Transas Marine Ltd. 1993-2011; Conning display/Radar/ECDIS)<br><br>•1 GMDSS simulator<br><br>• 30 seat Desktop based ship handling simulator (plus instructor station) produced by Shanghai Maritime University. (On hold May 2020) | • None declared (do not run navigation courses) |

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# Appendix Four: Miscellaneous Interactive Simulators and Resources

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • ARROW –simulator for Training of avoiding Roll Resonance in Heavy Weather and other Wave impact<br><br>• SIMOPT – Fast Time Simulation Optimization for Ship Models Generation & Standard Manoeuvres<br><br>• SIMDAT – Ship Simulation Assessment & Ship Trial Data Analysis<br><br>• Navigation Lab with original RADAR /ARPA system, NAV equipment Communication Station etc. | • Regs4ships programme for IMO convention and codes<br><br>• SPOS route optimizing program<br><br>• Several different stability programs | • TRANSAS on and offshore crane simulator<br><br>• Regs4ships programme for IMO convention and codes<br><br>• Compass Room<br><br>• Cargo Loading and Management Software |

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|---|---|---|
| • 40 x Rules Master for COLREGS / 20 x Maretek software for bridge equipment [both located in Computer lab]<br><br>• 8 bridge desktop simulators for Electronic Navigation Systems (ENS) operational and Management Courses (TRANSAS) | • None declared | • None declared |

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# Appendix Five: Engineering Simulation (Non-Desktop based)

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • One Full Mission Ship Engine Simulator (Manufacturer: Rheinmetall Electronics RME), with interactive Engine Control Room and Engine Room including Electric switchboard with Medium Voltage panel<br><br>• 5 Engine models for different type, Sulzer 5RTA84C & MAN 6S60MC 2-stroke Engine, MAK 8M32 inline 4-stroke Engine, CAT 3616 and Wärsilä 12V46 V-type engines<br><br>• Diesel electric machinery system and switchboard for azimuth propulsion<br><br>• Controllable and Fix Pitch Propeller Propulsion<br><br>• Diagnosis System for Cylinder & Injection Pressure, Crankshaft Revolution Analysis and Performance Monitoring<br><br>• Supply System Simulation including Steam Boiler and Turbine, Freshwater Generation, Bilge Oil Separator, Lube and Fuel Oil Purifier, Provision and Cargo Cooling System, HT,LT and SW Cooling<br><br>• SIEMENS Ship Automation System Simulator for cruise ship control of machinery system | • Full mission Engine room simulator running TRANSAS ERS 5000 Techsim<br><br>• HV training breaker<br><br>• Emergency switchboard trainer | • Full mission Engine room simulator running TRANSAS ERS 5000 Techsim<br><br>• Three TRANSAS virtual engine room booths with 120 degree field of vision and touch panels<br><br>• Two HV training breakers<br><br>• Emergency switchboard trainer |

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| | | |
|---|---|---|
| • UNITEST 3D ship engine simulator workstation | | |

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|---|---|---|
| • None declared | • None declared | • HV training breaker |

## Appendix Six: Engineering Simulation (Desktop based)

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • 12 instructorless (ILT) training stations with the full coverage of functions in the full mission simulator versions | • 15 TRANSAS PC workstations simulators, each with 2 monitors. | • 24 PC workstations, each with three monitors (dual Deck/Engine).<br><br>• Two 24 station CAD and Naval Architecture analysis suites running Maxsurf, Lloyds SSC and Wolfson Unit programmes for design analysis. |

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|---|---|---|
| • Non-functional TRANSAS simulator (outdated) – license only – update & installation required. | • None declared | • 15 TRANSAS PC workstations simulators, each with 2 monitors. |

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# Appendix Seven: Engineering Workshops/Laboratories

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • Main machinery ( 4-stroke, supercharged diesel engine 6L23/30A with hydraulic dynamometer and generator, local and remote operator's platform, separator)<br><br>• Engine Control Room (remote control of main machinery, exhaust measuring equipment from ABB-AO2020, fire alarm system for education purposes)<br><br>• Auxiliary machinery system (compressor plant, hydraulic workstation, pneumatic test stand, pump test stand, room air cell, bilge water oil separator, diesel engine 8NVD36, two diesel engine 4NVD26)<br><br>• Power generator laboratory (diesel and gas generators with heat extraction to buffer storage, permanent and controllable resistors, heat-controlled block heating station with stratified storage and coupling to heater test station and with sea water evaporation plants, main switchboard) | • Four lathes, two milling cutters and other metal working equipment<br><br>• Six welding bay stations for Stick/MIG/TIG<br><br>• Steam boiler Laboratory<br><br>• Auxiliary/Emergency engine Laboratory<br><br>• Non Running Wärtsilä 6L20 engine<br><br>• Running Wärtsilä Wasa 4L32 engine<br><br>• Misc control equipment | • Twelve lathes, four milling cutters and other metal working equipment<br><br>• Eight welding bay stations for gas, electric arc, MIG and TIG<br><br>• Thermodynamics Laboratory<br><br>• Materials Testing Laboratory<br><br>• Applied Mechanics Laboratory<br><br>• Composite Materials Laboratory<br><br>• Advanced Manufacturing Laboratory<br><br>• Small Vessel Engineering workshop<br><br>• Auxiliary systems workshop<br><br>• Non Running MAK 6M20 engine, with working lubricating oil and starting air systems, capable of being blown over on air<br><br>• Running Volvo Penta engine with genet and distribution panels |

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| | | |
|---|---|---|
| • Steam boiler laboratory (steam boiler for heating oil or natural gas, heating systems test station with 3 heating circuits, surface condenser, tube heat exchanger, sea water evaporation plants)<br><br>• Steam turbine test stand (balanced pressure condensation turbine, SSTK 25/0.2/5)<br><br>• Refrigeration laboratory<br><br>• Workshop (welding stations for MIG/MAG/Plasma, lathe, milling machine, test device for injection nozzles)<br><br>• Fuel and process material laboratory (density meter, viscometer, etc.<br><br>• Engine Lab specific Seminar room with 36 places | | • Misc control equipment |

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|---|---|---|
| • Demonstration models (Boiler x 2, turbocharger, fuel pumps & injectors, variable displacement pump, other basic illustrative models – various] | • None declared | • Non running Wartsila W20-8L-Non running Wartsila W26-6L<br><br>• 2 x Refrigeration training unit.<br><br>• Fluids LAB-Material testing LAB-Renewable energy LAB-<br><br>• Hand Skills Laboratory<br><br>• Fluids Laboratory<br><br>• Material testing Laboratory<br><br>• Renewable energy Laboratory |

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# Appendix Eight: Automation and Electrical Engineering Laboratories

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • Electrical engineering lab (electrical resistors, alternating and three-phase current)<br><br>• Automation, regulation and control workstations (software as e.g. LOGO!, Simatic S7, Damatic)<br><br>• Electrical engineering workstation (asynchronous machine, synchronous machine, frequency converter, transformers, medium-voltage switchgear) | • Marine Electro-technical Laboratory | • Marine Electro-technical Laboratory<br><br>• Electrical engineering lab (electrical resistors, alternating and three-phase current)<br><br>• Electrical and Control engineering Workstations<br><br>• Robotics Laboratory included a Baxter Robot |

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|---|---|---|
| • None declared | • None declared | • Siemens Automation LAB-Electro-technical LAB |

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# Appendix Nine: Survival Training

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • No specific equipment on campus, because all relevant training is delivered in close co-operation with AFZ maritime training centre in Rostock | • Survival Pool (5m x 16m x 2,5m), equipped with 6 and 12 person liferafts, immersion suits and life jackets<br><br>• Two set of waterside davit facility for lifeboat (and one set FRB davits coming)<br><br>• One fully enclosed and one open lifeboats, one FRC | • Two totally enclosed motor propelled survival craft (TEMPSC) on outrigger davits.<br><br>• Selantic escape system.<br><br>• Partially enclosed lifeboat (PELB).<br><br>• A 6.8m MCA-coded RIB made by RIBCraft with a 175hp outboard engine and fitted with four shock mitigation seats, plus nine-inch HD chart plotter and VHF radio.<br><br>• Two open lifeboats.<br><br>• Fast rescue boat<br><br>• Survival pool (varying depth), equipped with 6 person liferafts, immersion suits and life jackets, 3m high board and HUET.<br><br>• Fire fighting training unit<br><br>• Specialist survival training rooms |

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|---|---|---|
| • Survival Pool (12m x 7m x 2.5m) heated<br>• 6 person HUET (non-OPITO)<br>• Three fully enclosed lifeboats<br>• One open lifeboat<br>• 2 Fast rescue Boats (semi rigid)<br>• 1 Davit launched liferaft<br>• 2 Throw over liferaft<br>• 1 Heliraft<br>• Immersion suits<br>• Medical aid training equipment<br>• 3 classrooms (30 pax each) full AV & smartboard<br>• 1 meeting room (full AV & smartboard) | • None declared | • Swimming pool<br>• Fire fighting training unit (in progress )<br>• 4 life raft (dry and wet training)<br>• Medical aid training equipment.<br>• 12 Immersion suits |

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# Appendix Ten: Classrooms and other Specialist Spaces

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • 17 class and seminary rooms: with up to 130 places, equipped with beamer, white and/or black boards, projectors and WIFI, one special navigation room with 28 chart tables<br><br>• 2 conference rooms: with 10 resp. 30 places, equipped with beamer and teleconference system<br><br>• 1 PC laboratory: with 12 workstations and software licences for Matlab®, CAD/CAE, memory-programmed control, process visualization, construction programs especially for technical engineers, simulation and calculation software for nautical studies, MS Office®<br><br>• 1 language laboratory: with 18 workstations<br><br>• Campus library attended by one librarian: with more than 18000 medias, 24 current journals and magazines, interlibrary loan possible, online medias available<br><br>• Main library in Wismar: with more than 65000 medias, online medias, interlibrary loan | • Classrooms equipped with 75” touch-screen displays, lecture capture<br><br>• 100 seat Lecture theatre equipped with webcast technology<br><br>• Two deck hand workshops with ropes, wires, cargo securing and ship maintenance facilities | • 14 teaching rooms, equipped with touch screens and lecture capture, WiFi. Some rooms are dedicated to specific courses (eg HELM, Engineering, Navigation)<br><br>• Learning resource area dedicated to maritime students<br><br>• Shared use of general University library facilities, but with one dedicated maritime librarian<br><br>• Shared use of University IT facilities, with 400 workstations and software licences for various maritime applications, Matlab®, CAD/CAE, memory-programmed control, process visualization, construction programs especially for technical engineers, simulation and calculation software for nautical studies, MS Office®<br><br>• One deck hand workshop with ropes, wires, cargo securing and ship maintenance facilities<br><br>• Stability tank |

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|---|---|---|
| • Maretek software for instructor - bridge equipment interaction in classroom environment<br><br>• 60 seater classroom for Marine Engineering (EOW level)<br>[smartboard, projector, Desktop PC)<br><br>• 60 seater classroom for Navigation (OOW level)<br>[smartboard, projector, Desktop PC]<br><br>• 30 seater classroom for Marine Engineering (Management level)<br>[Projector, Desktop PC]<br><br>• 60 seater classroom for Navigation (Management level)<br>[Projector, Desktop PC]<br><br>• 20 seater classroom for Extended Curriculum Program<br>[Projector, Desktop PC] | • One specialist class room with 15 desktop PCs, Projector and Smart board with Wi-Fi & cable Internet connection (3G)<br><br>• Three additional class rooms are equipped with projectors, smart boards and Wi-Fi (3G).<br><br>• 100 desktop PCs for applied science, teaching spaces with projector,<br><br>•Black board<br><br>• Wi-Fi & cable Internet connection (3G) | • Stability tank<br><br>• 200 seat lecture theatre 2 per 6x6 meter projector screen.<br><br>• 15 seat class room with 60'' interactive screen (webcast available)<br><br>• 20/80 seat Marine lecture and SLP. |

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# Appendix Eleven: Miscellaneous other Facilities

| Hochschule Wismar | Satakunta University of Applied Sciences | Solent University |
|---|---|---|
| • Free WiFi on the whole campus<br><br>• Study capacity in library<br><br>• For all branches of studies specialized literature in the campus library<br><br>• One child care room | • Sauna<br><br>• Large scale cargo handling facility with derricks | • Free WiFi on the whole campus<br><br>• 60 metre towing tank with wave generator<br><br>• Manned model ship handling centre with 13 large scale manned models, harbour areas and 17 jetty combinations, shallow water manoeuvring area and canals |

| Cape Peninsula University of Technology | Durban University of Technology | Nelson Mandela University |
|---|---|---|
| • Fathom 10 – small operational training vessel for navigational instruction. | • None declared | • None declared |