



mates

Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy



Co-funded by the Erasmus+ Programme of the European Union



CIFP Ferrolterra

Highlights of MATES Pilot Experiences Freeboard Project

Layman Report

December 2021



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About this Report

This document was developed through the EC-funded Erasmus+ project **MATES: Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy**.

The objective of the MATES project is to develop a skills strategy that addresses the main drivers of change in the maritime industries, in particular shipbuilding and offshore renewable energy. Both sectors are strongly linked and require new capacities to succeed in an increasingly digital, green and knowledge- driven economy.

Duration: January 2018 – April 2022 (52 months)

More information on the project is available at projectmates.eu

Document information	
Short description	Summary of the Pilot Experience Freeboard and its results.
Next steps	The model will allow us to go on improving learning methodology closer to the labour market with future students and will also allow us to do trainings related to health and safety conditions. It is planned to equip the ship with all kinds of required services that could be included in a ship as the engine room of a real ship so that all departments of this VET school will be involved in it.
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Partners involved:



XUNTA
DE GALICIA

CONSELLERÍA DE
CULTURA, EDUCACIÓN
E UNIVERSIDADE



Navantia

1. Context

MATES: Maritime Alliance for fostering the European Blue Economy through a Marine Technology Skilling Strategy is an EC-funded, ERASMUS+ project whose objective is to develop a skills strategy that addresses the main drivers of change in the maritime industries, in particular shipbuilding and offshore renewable energy.

The MATES Pilot Experiences (PEs) are vital components of the strategic design of the project. They consist of a series of activities that fall in line with the priority areas needed to support training and development of the shipbuilding and offshore renewable energy industries. This report summarises the outcomes and learning elements from one of these Pilot Experiences: *Freeboard*.

Target beneficiaries include students, teachers, trainers, skilled workers and those who have recently joined the workforce. The outcomes of the Pilot Experiences provide indispensable knowhow for bridging the maritime skills gap and increasing both sectors' overall competitiveness and attractiveness. The insights gained from these activities feed directly into the long-term MATES Action Plan, which contains policy recommendations and best practices.

Results from these Pilot Experiences are particularly relevant for the following stakeholder groups:

- **Local Government in charge of education**
- **Industry**
- **Research and Development Centres/Universities**
- **Vocational and Educational Training (VET) Centres**
- **Secondary Schools**

This PE includes the collaboration of Navantia¹ and therefore students had the opportunity of taking Work-Based learning (WBL) at school by building a block of a life-size vessel.

This new approach in teaching, focusing on labour market requirements, can make a significant contribution to increasing VET quality and attractiveness².

Transversal skills such as critical thinking, entrepreneurship and problem-solving are promoted; just some of the competences enshrined by the Skills Agenda for Europe³. The acquisition of such skills, of values and attitudes, requires the use of more participatory learning methods. By building this ship block, students' confidence, teamwork and organizational skills are enhanced.

A shortage of suitably skilled workers has been identified as blocking growth in nearly all blue growth economic sectors⁴. The proposed WBL space will contribute to strengthening the shipbuilding sector with a skilled labour force which responds to labour market needs⁵.

¹ <https://www.navantia.es/en/>

² P. O. of the E. European Commission and DG Employment, 'Business cooperating with vocational education and training providers for quality skills and attractive futures.', EU publication, Dec. 2017

³ European Commission, 'Blueprint for Sectoral Cooperation on Skills in a Nutshell', p. 2.

⁴ 'Blue Growth opportunities for marine and maritime sustainable growth', Policy Document

⁵ European Commission, 'Work-based learning in Europe: Practices and policy pointers', Jun. 2013.

2. Overview of the Freeboard PE

2.1. The aim

CIFP Ferrolterra is a technical VET school located in Ferrol (North West of Spain), where Navantia, one of the most important shipyards in Europe, is also settled. Once they have completed their VET degree, most of our students are employed either by Navantia or by one of the auxiliary companies related to it.

The Freeboard PE’s main goal was to **provide a naval work environment for students and to simulate the work conditions of a real shipyard**, which is the most likely workplace for our students in the future. As a result, a **real-scale part of a ship’s hull was constructed**.

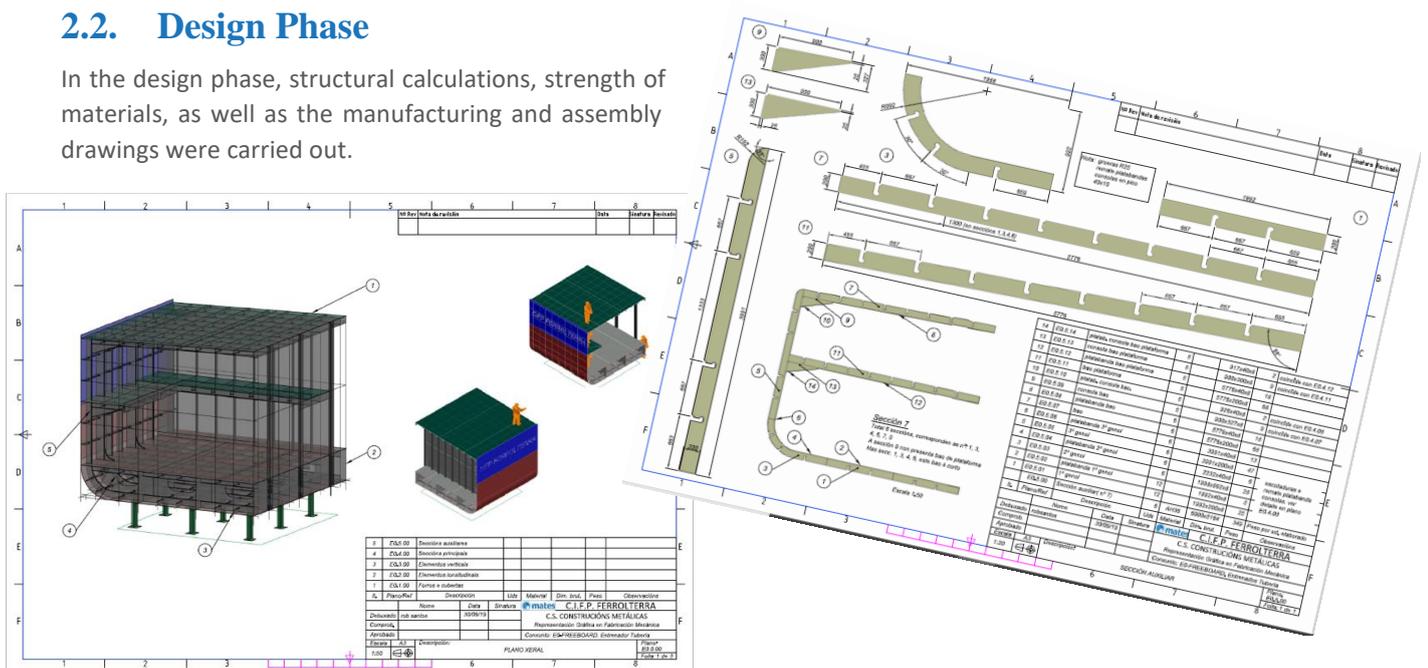
Specific objectives of Freeboard were:

- Enhancing their abilities and skills, connecting educational learning with this region’s labour market
- Training for students in professionally-orientated installations.
- Innovative Technology: Using *block assembly process* (not usual in Educational Training methodologies) and Industry 4.0 (Welding with ABB robots).
- Enhancing and developing other professional skills such as:
 - Creative and innovative ideas, to tackle the difficulties and problems which appeared during the construction process.
 - Decision-making skills, merging multidisciplinary knowledge and work, taking risks in order to be able to respond appropriately to unforeseen problems.
 - Teamwork and leadership, due to work with several departments, classmates, etc.
- Health and safety conditions will be embedded: work at heights, handling loads, working in confined spaces, scaffolding, etc.

The “Freeboard” term comes from naval terminology and means the distance from the waterline to the upper deck level of a boat. This term is used as a metaphor for the distance between the educational system and the labour market, which this project aims to reduce.

2.2. Design Phase

In the design phase, structural calculations, strength of materials, as well as the manufacturing and assembly drawings were carried out.



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In addition, occupational risk studies, task planning, manoeuvre planning, and all those factors that may affect construction were carried out.

The main steps of the planning and design stage were:

- Designing and defining technical specifications for the mechanical work.
- Understanding technical documentation, doing a state-of-the-art in order to identify materials required for the construction phase.
- Assessing costs of the project, using commercial and technical information, manufacturers' invoices, etc., in order to be within the approved budget.
- Applying CAD working techniques for the design according to the rules of naval policies.

This phase was carried out by Mechanical Manufacture Design students and their teachers.

2.3. Construction Phase

Regarding the construction phase, the same methodology and designing standards as shipyards, named block assembly process, were used.

The block assembly process consists of manufacturing small pieces, called assemblies. These assemblies are joined to a larger one, called a block, and these blocks are joined together into another larger block, which is the section that we constructed. In a real shipyard, several sections are made in this way, and joined to complete an entire ship.



This phase was carried out by the students of two different speciality degrees: Welding and Boiler making, and Metallic constructions.

The main steps of the

Construction and Assembly phase were:

- Solving potential problems in assembly, using economical, safety and practical criteria.
- Assembling the structure, following drawings and performing the necessary tests, to monitor equipment and associated elements.
- Identifying standard components that can be used in the design of the block.
- Selecting tools and necessary equipment.
- Using the techniques to trace, cut, mechanize, welding, etc. describing the operative sequence to cut and assemble the pieces.

Navantia provided some of the materials as well as advice on the development of the ship's hull. This ensured that the finished hull was developed in compliance with industry standards.

2.4. Painting Phase

An external company, Blascar shipyard⁶, carried out the grit blasting (abrasive surface cleaning process) after which the students of Welding and Boiler making painted the ship-block in October 2021.



2.5. What's next

In the future, it is planned to equip the ship-block with pipes, pumps, valves, electrical and telecommunications equipment and machinery just as in the engine room of a real vessel, with the aim of involving all the departments of the VET school in this way. It was also deemed important to perform repairs, since vessels can also suffer damage.

A new design phase began in October 2021 with the Metallic Constructions students and Mechanical Manufacturing Design students. In this phase, the students are engaged in designing the layout of the interior pipes and valves of the ship. Handrails, exterior stairs and an annex room to store tools are also in the design phase.

In addition, Health and safety courses will be undertaken: work at heights, fall arrest system, handling loads, working in confined spaces, scaffolding, etc.

The next courses will be held at the ship-block. A new course on work at heights is planned specifically for mechanical manufacturing students to ensure the safety at their work and enhance their employability.

⁶ <http://www.blascar.com/blascar-naval/empresa/>

2.6. Dissemination

The local media and press understood very clearly the purpose and the results of the project. Headline news were: Apprenticeship in a little shipyard! & A Mini shipyard within school to learn shipbuilding techniques.



A documentary of the process was published [in this video](#).

Fifty companies were invited to visit the block which had been constructed for lifelong learning (LLL) in September 2021, among which were Navantia, Windar⁷ and CT Ingenieros⁸.

As a result of the press release and the dissemination efforts, companies such as Navantia or CT Ingenieros offered Dual studies in the 2021/2022 academic year at school and more agreements of Dual studies in welding with Gabadi⁹ or Windar have been made for the 2022/2023 academic year.

Summary of Participants Engaged in Freeboard

Location	Galicia (Spain)	CIFP Ferrolterra (Ferrol)
Participants in 2019/2020	4 teachers	34 students
Participants in 2020/2021	6 teachers	104 students

⁷ <https://windar-renovables.com/en/>

⁸ https://www.ctingenieros.es/index.php/home/?idioma_id=4

⁹ <http://www.gabadi.com/>

3. Achievements

The constructed ship hull provides a working environment for students to carry out technical training in a setting comparable to real-life. They will experience conditions that they would face in a real work environment. Hands-on training can be carried out under controlled conditions with the same materials and design standards as conventionally used in shipyards.

3.1. Main Results

3.1.1. A naval work environment for VET students

The main purpose of the entire PE was **to simulate work conditions of a real shipyard**, where most of our students are likely to work in the future, and to achieve the purpose, **a real-scale part of a ship's hull was designed, built and painted**.

In the future Plumbing (pipes, valves, connectors) and other type components (electrical, heating etc.) will be installed so that all departments of the VET school will be involved in the process, as well as performing repairs of the structures.

All the plots, exploded views and cutting details are available on [MATES website](#)¹⁰ for download, enabling others to replicate the model (assembly is included in the plots in order to replicate the model in other VET schools if wanted).

Tubular welding and assembly work form part of the educational curriculum of the VET students of Welding and Boiler-making and HE students of Metallic Constructions. Both groups improved those skills “learning by doing” during the construction phase of this project, facing real working conditions. Block Assembly Process and same standards and methodologies as in shipyards were applied in this Pilot Experience.

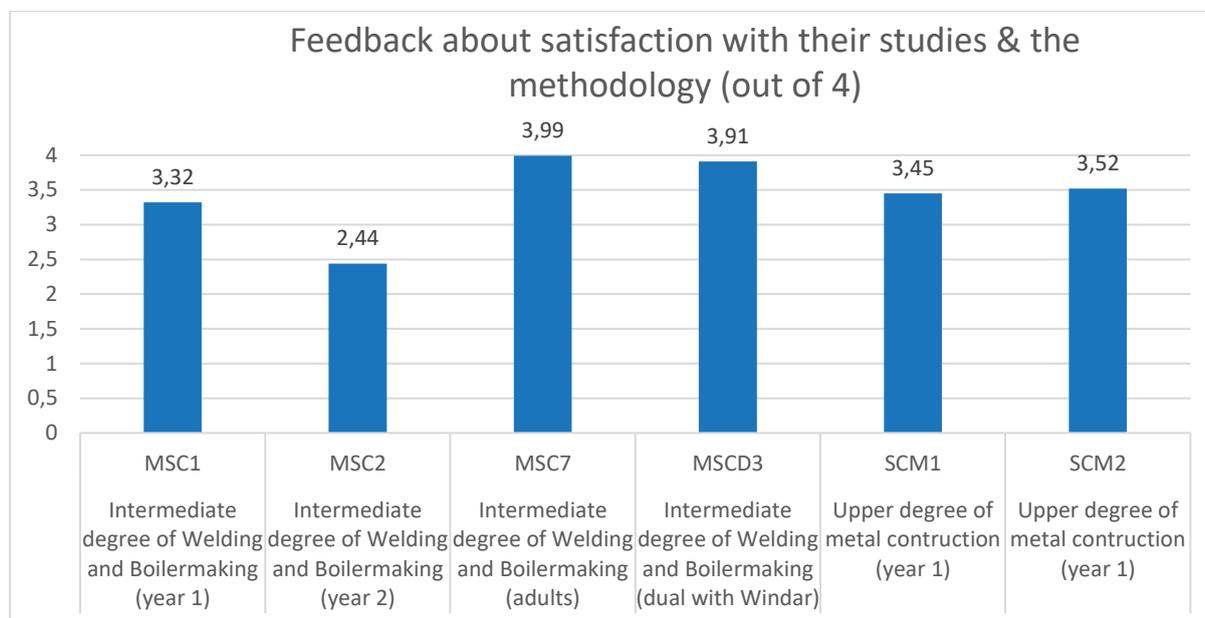
Participants **learned to** carry out the processes of the manufacture, assembly and repair of boiler-making elements, pipes, metallic structures and metallic joinery applying techniques of welding, machining and shaping, and complying with the specifications on quality, labour risk prevention and environmental protection.

- Applying labour and ethic habits in his/her professional activity according to the characteristics of the job position and the procedures established.
- Preparing materials, equipment and machinery for the scribing, cutting, machining, shaping and joining of elements, building structures, metallic joinery and industrial piping installations, in accordance with the established procedures, applying the regulations concerning labour risk prevention and environmental protection.
- Machining and shaping sheet metal, profiles and pipes, in accordance with manufacture specifications, applying the regulations concerning labour risk prevention and environmental protection.
- Fitting pipes, metallic structures and metallic joinery, complying with the plans concerning labour risk prevention and environmental protection, from the provided technical documentation.
- Obtaining welded or surfaced sheet metal, profiles and pipes through electric welding, oxy-fuel gas welding, TIG, MAG/MIG, submerged arc welding and surfaces through thermal or arc spraying from the building plans complying with the plan on labour risk prevention and environmental protection.
- Verifying dimensions and characteristics of manufactured pieces, following the instructions established in the control plan.

¹⁰ <https://www.projectmates.eu/pilotexperience/freeboard/>

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The Figure below shows the results of the students' satisfaction surveys. It reveals a good overall satisfaction rate: 3.42 out of 4. Each bar represents a cohort of students. Two different degrees, an intermediate and an upper one, participated in the Freeboard structure construction. There are four groups for the intermediate degree and two for the upper one. The lowest rate corresponds to second year students of the Intermediate degree regular courses, and the highest to the same degree but provided to adults (evening classes). Those enrolled at a dual programme (MSCD3) gave the second highest rate.



3.1.2. Materials to promote careers in metal working and shipbuilding

The Freeboard Pilot Experience is presented [in this video](#) by “La Voz de Galicia” local press to attract students to metal working and shipbuilding careers in Galicia (2:15 minutes). These materials are **also used to break gender stereotypes** by giving visibility to female teachers and students.

#ErasmusMATES #CIFP Ferrolterra # WorkBasedLearning



3.1.3. Additional Courses

Four additional courses took place in the framework of this PE.



Naval specific vocabulary

A short course about Naval terminology was taught by CT Ingenieros to 12 students enrolled at the dual course established in collaboration with that company.

Learning outcomes

- Identifying parts in drawings and following instructions to assembly them.



Specialized welding course for teachers

A Course on special tubular welds in aluminium, stainless, carbon steel and the FCAW (Flux Core Arc Welding) process was organized in conjunction with the CFR Ferrol¹¹ for teachers. The aim was to upskill the VET teachers in order to be able to transfer these knowledge and skills later on to their students. The training was held from 6th to 10th September 2021.

Learning outcomes:

- Management of TIG and semi-automatic welding equipment.
- Protection gases for the realization of welded joints.
- Aluminum, stainless steel and copper-nickel alloy welded joints



Upskilling Course on Industrial pipes for workers

ASIME organized an 80-hour course in the CIFP Ferrolterra facilities, where the ship-block was used by their students to take measurements and do the stakeout of a pipe installation in it. Programme [here](#).



Health and safety conditions courses: work at heights, fall arrest system

An 8-hour training on working at heights was done for 92 participants in 2020 (with a global satisfaction survey of 3.74 out of 4).

Learning outcomes:

- Recall about applicable Regulations
- Practising techniques for working on roofs, decks, stairs, scaffolding, ladders and mobile elevating working platforms (MEWPs)
- Accessing and positioning with ropes. Placing temporary horizontal anchor lines. Progression with double rope, fall arresters and vertical anchor lines.
- Identifying fall protection systems
- Putting on a harness and choosing the right Personal Protective Equipment (PPE)

¹¹ CFR Ferrol is a Continuing Professional Development (CPD) centre for teachers. <https://www.edu.xunta.gal/portal/crferrol>

3.2. Impact

The same methodology and design standards as shipyards was used which enabled the students to gain experience in real working conditions. These students have already enhanced their competences and skills and as such the Pilot Experience will impact their employability as they have gained experience relevant to industry's needs.

Number of departments using the ship's hull in their training	1
Number of companies using the ship's hull in their training	NAVANTIA through the whole Pilot Experience and ASIME undertaking a course
Number of teachers/VET schools/institutions using the ship's hull in their training	4 in 2019/2020 & 6 in 2020/2021
Number of students participating in the training (in other department/companies/VET schools/institutions)	34 in 2019/2020 and 104 in 2020/2021.
Feedback from students of Mechanical manufacturing in CIFP Ferrolterra who participated in the course	The average satisfaction rating is 85.5%.
Number of Dual programmes established as a result of the PE	<p>4 (with Navantia, CT ingenieros, Gabadi and <u>Windar</u>).</p> <p>The Portuguese company Terralwind¹² is also negotiating a Dual FP training agreement with CIFP Ferrolterra. Terral Wind considers the Freeboard hull a highly valuable resource for training students in a confined space. Renewable energy students must regularly work in wind turbine nacelles and must carry out training for working in a confined space.</p>
Number of new specialities	<p>1</p> <p>A course on naval qualifications and ship services will be provided jointly with Gabadi during the course 2022/2023. This course has been approved to be run in experimental mode. This naval course will make use of the ship's hull.</p>
Attractiveness	VET Enrolments increased in 2021/2022. It was found that many students who enrolled were aware of Freeboard because of the promotion that was carried out. The places offered in welding and boiler-making were also filled more quickly compared to previous years.

¹² <http://terralwind.com/>

OUTCOMES

- Two companies signed Dual programmes with the CIFP Ferrolterra as a result of the implementation of this PE. With Navantia & CT Ingenieros in the 2021/2022 academic year and with Gabadi & Windar renovables in the 2022/2023 academic year
- Despite the pandemic, labor insertion surveys show a stable trend in the specialities of welding and boiler-making and mechanical manufacturing design. Companies are very interested in our students, therefore we can say that this PE has improved their employability.
- Student satisfaction surveys show a good overall satisfaction rate: 3.42 out of 4
- This PE has also contributed to enhancing VET Attractiveness: Enrolments in our centre increased in 2021/2022.

4. European Added Value

The MATES project enabled us to build a ship's hull at the CIFP Ferrolterra centre, which provides a working environment for students to carry out technical training in a setting comparable to real-life. In this way, the students experience conditions that reproduce those that they would face in a real work environment. This Pilot Experience gave students the opportunity of taking Work-based learning (WBL) at school by building a block of a life-size vessel. Hands-on training was carried out under controlled conditions following industry standards and using the same materials as shipyards.

This new approach in teaching focusing on labour market requirements will contribute to **increasing VET quality and attractiveness**¹³.

Transversal skills such as **critical thinking, entrepreneurship and problem-solving are promoted**; just some of the competences enshrined by the Skills Agenda for Europe¹⁴. The acquisition of such skills, of values and attitudes, requires the use of more participatory learning methods. By building this ship block, students' confidence, teamwork and organizational skills were enhanced.

A shortage of suitably skilled workers has been identified as blocking growth in nearly all blue growth economic sectors¹⁵. The proposed WBL space contributed to strengthening the shipbuilding sector with a skilled labour force capable of responding to labour market needs¹⁶. The results demonstrated the **added value of enhancing relationships between industry and education**.

For those interested in replicating this activity in a VET centre, it is recommended that the following key learning elements should be taken into consideration:

1. **Working with industry collaborators:** This is key to ensure that the training follows industry standards and bridges the gap between industry needs and training offer.
2. **VET teachers' involvement:** This kind of training motivates students and therefore facilitates teachers' work, even though it requires better planning and a different evaluation method.
3. **Disseminating progress:** This kind of teaching approach will increase student interest for that specific professional path and also the VET centre's reputation.

¹³ P. O. of the E. European Commission and DG Employment, 'Business cooperating with vocational education and training providers for quality skills and attractive futures.', EU publication, Dec. 2017

¹⁴ European Commission, 'Blueprint for Sectoral Cooperation on Skills in a Nutshell', p. 2.

¹⁵ 'Blue Growth opportunities for marine and maritime sustainable growth', Policy Document.

¹⁶ European Commission, 'Work-based learning in Europe: Practices and policy pointers', Jun. 2013

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“We encourage all vocational training centers to carry out this type of projects so that our students of today can become the workers of tomorrow”

BENITO CHANS, Vocational Education Teacher in Welding at CIFP Ferrolterra



“As conclusions we would like to point out that Freeboard promotes *Hands on methodology* improves abilities and skills of students. Students face real work conditions this way and this fact prepares them better for the labour market”

RAQUEL RODRÍGUEZ, Vocational Education Vicedirector CIFP Ferrolterra

“This project enables the students to experience a real work environment from the first moment, improving their employability.

DAVID SEDES, Vocational Education Teacher in Welding at CIFP Ferrolterra

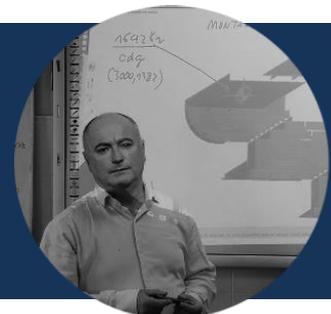


“I did not know what the structure of a ship was like until I participated in the Freeboard project at CIFP Ferrolterra.”

IRIA GARCI, VET student of Metallic Constructions

“Our students learn that design, planning and coordination are key to developing successful and quality projects.

ROBERTO SANTOS, Vocational Education Teacher in Design at CIFP Ferrolterra



All Layman Reports and education and training materials from all the MATES Pilot Experiences are available on the MATES website and include:

ED2MIT: Education and Training for Data Driven Maritime Industry projectmates.eu/pilotexperience/ed2mit
MOOCs on Industry 4.0 and the naval sector projectmates.eu/pilotexperience/mooc-training-course
Freeboard projectmates.eu/pilotexperience/freeboard
The Magnus Effect projectmates.eu/pilotexperience/the-magnus-effect
Innovation Manager in Shipbuilding Course projectmates.eu/pilotexperience/innovation-manager-course
Additive Manufacturing and Risk Management in the Shipbuilding and Ship Repairs Sectors projectmates.eu/pilotexperience/training-seminar
MOL² Maritime on the Loop of Ocean Literacy projectmates.eu/pilotexperience/mol2
Offshore Renewable Energy Courses projectmates.eu/pilotexperience/renewable-energies-crash-courses
Ocean Pro.Tec Lab projectmates.eu/pilotexperience/ocean-pro-tec-lab
Green Move projectmates.eu/pilotexperience/green-move
Definition of New Occupational Profiles projectmates.eu/pilotexperience/dop-definition-of-new-occupational-profiles





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