

GMT **by** ACLUNAGA



Development of technologies focused on automatic assembly and welding operations of naval elements and structures

Detegasa applies Augmented Reality to digitalize its *Know How*

Despite everything, Logistics Networks are working

The Sea Cloud Spirit of Metalships&Docks, outstanding Shipbuilding of the year 2020

Shipbuilding ecological and energy transition: a strategic proposal for the Galician Shipbuilding Sector

Additive manufacturing present and future, status and challenges

Interview with: BOTAMAN

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GALICIAN MARITIME TECHNOLOGIES // n°9 // 2022



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In the energy field, we usually define Spain as an island. Its interconnection with the European network is scarce, something that has consequences. Even before the situation arising from the conflict in Ukraine, moments of high gas prices and those of conventional sources have had a very significant impact on electricity prices. In this context, it should be noted that the expansion of Renewables, which today no one disputes as an unstoppable reality, not only contributes to the reduction of CO₂ emissions but also has another particularity: it makes energy cheaper.

Galicia has large experience in this type of generation, which is now at a crucial moment. For this reason, we must decisively promote our capabilities. On one side, through the repowering of the wind farms located on land, since we enjoy one of the best wind resources in the country. On the other side, through offshore wind power, which in our community has an entire industrial ecosystem accompanied by tradition in shipbuilding.

Regarding offshore wind energy, we face important challenges in the coming years, such as improving designs, lowering costs, manufacturing components, and even the operation and maintenance of wind farms. We cannot miss this opportunity, since we have companies capable of developing the whole range of technologies, and what is also very relevant, in the Galician coast there are areas with great possibilities for the implementation of floating parks.

There is, therefore, a double benefit. On the one hand, for industry, and on the other, in energy production. It is worth remembering that the greater the contribution of renewables to the system, the

lower the price, and at this time, as we know, the impact of energy costs on our economy is worrying. In addition to these benefits, in the future, the possibilities opened up by the use of hydrogen as a storage system.

Regarding the commercial part, this is a purely exporting sector, with high added value and whose maturity curve still has a long way to go. In Spain there are currently more than 150 companies working in the development of offshore wind energy, from promoters to manufacturers. In addition, we have adequate ports. In the end, we are in a leadership position.

To take advantage of it, it is essential that the Administrations with competencies, especially the Xunta, complete the regulation, that the auctions are called, and that we have marine spaces at economically viable distances. This work must be done rigorously to ensure environmental protection, in the same way as has been achieved throughout Europe, and to seek an understanding with the fishing sector.

The expected evolution of offshore wind energy in the world is exponential. To meet climate commitments, we would have to move globally from around 230 gigawatts in 2030 to 1,000 gigawatts in 2050. If the Ministry for Ecological Transition's roadmap is achieved, Spain's floating wind power installation targets will stand at 30 gigawatts by 2030.

In short, we are talking about a major industrial and technological opportunity that, in addition to creating wealth and employment, will help to keep energy prices regulated and low. Let's take advantage of it.



ÁNGEL MATO ESCALONA

Mayor of Ferrol and Secretary of Industrial Policy and Energy Transition of the PSdeG-PSOE

Development of technologies focused on automatic assembly and welding operations of naval elements and structures



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At present, the installation of Component Assembly and pre-fabrication elements (pipe supports, electrical conduits, etc.) is carried out entirely manually. Within the framework of the NAUTILUS Mixed Research Unit jointly developed by NAVANTIA and AIMEN, two demonstrators have been developed for the validation of different technologies, in order to evaluate the possibility of carrying out a future pre-industrial development for some of the applications under study, in the search for a productivity and quality improvement in the assembly process which could be integrated in the future block factory which NAVANTIA is already developing at its facilities in Ferrol.

Introduction to the Mixed Unit "NAUTILUS".

NAVANTIA has launched several initiatives in recent years aimed at experiencing a significant improvement in its manufacturing processes. Among these initiatives, the "NAUTILUS" Mixed Research Unit (UMI) stands out, in which the developments are divided into two clear aspects: On the one side, the development of new MANUFACTURING PROCESSES and, on the other, the development of new PRODUCTS WITH HIGHER ADDED VALUE.

This article focuses on NEW MANUFACTURING PROCESSES and, in particular, on the development of robotized solutions for the early stages of vessel production, such as the manufacture of minor component assembly and the installation of pre-outfitting elements during the fabrication of Sub-blocks.

The robotization of operations in shipbuilding is still a field with great potential for development. This is a "One-of-a-kind" production, which, together with the large size of the components, means that robotization is not a widespread reality in the sector, both because of the technical difficulties of the developments and the lack of business visibility when evaluating the profitability of the investment. Barely a few large shipyards in the world have implemented automated/robotized solutions, and they are practically reduced to the panel line. However, the application of robotics to other operations is still a challenge for the shipbuilding sector.

Demonstrator 1: Minor Component Assembly

The first of the demonstrators focuses on the robotised positioning and tack welding of elements such as bulbs and platens, and L- and T-profiles that are disposed on a base plate.

Figure 1 shows the design of the developed cell, integrated by a handling robot for the positioning of the elements of the component assembly, and an inverted welding robot applied to tack and welding of different elements arranged in the robotic cell.

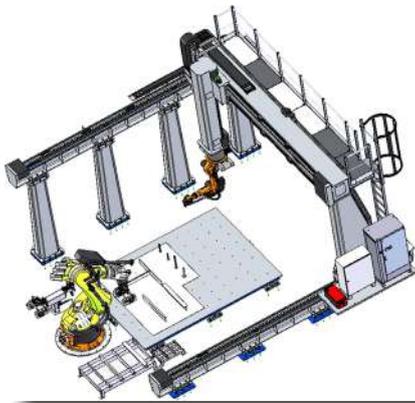


Figure 1. General view of the robotic cell design for the assembly and positioning of elements in component assembly.

Figure 2 shows a side view of the work cell showing both robots (above), as well as a view of the realized demonstrator (below).

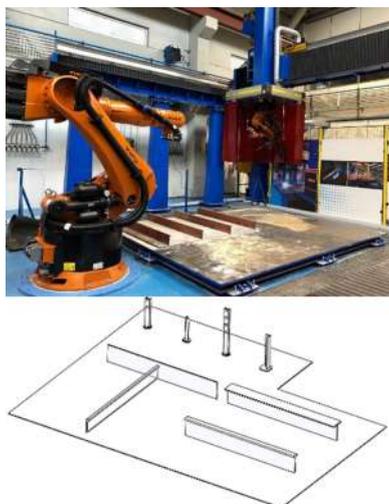


Figure 2 shows a side view of the work cell showing both robots (top), as well as a view of the realized demonstrator (bottom).

For the manipulation of reinforcements, a specific claw consisting of a pneumatic parallel jaw gripper, an open gripper sensor and a reinforcement presence sensor had to be developed and integrated into the robot wrist (Figure 3). The claw integrates a load cell to improve accuracy during assembly, detecting the absence of gap between components, thus avoiding any kind of separation between elements that would affect the quality of the welding process.

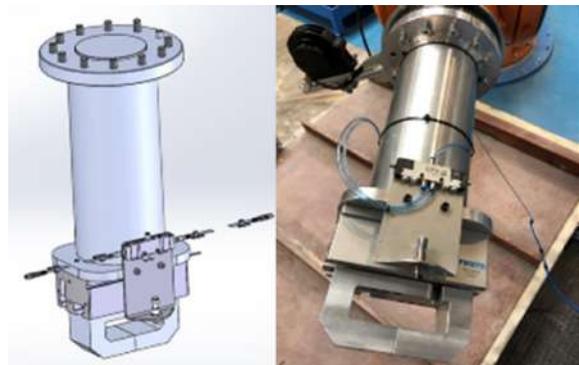


Figure 3. Claw integrated in robot wrist for reinforcement manipulation.

Likewise, for the accommodation of the different types of reinforcements, a basket was designed and manufactured (Figure 4).

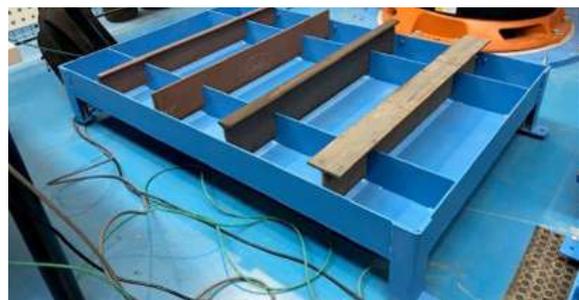


Figure 4. Basket for the accommodation of reinforcements.

In order to automate the reinforcement assembly operation, software based on matching CAD technology was developed.

The CAD information comes from a STEP file in which the objects that are part of the component assembly are identified: base plate, reinforcements and supports. Each object has properties, descrip-

tion-name that allows its identification. The matching CAD system reads the relative position of the objects with respect to the base plate. The scheme of the process is shown in Figure 5.

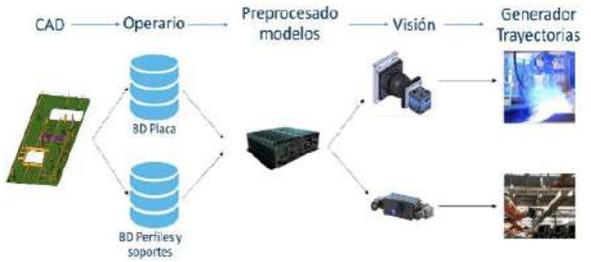


Figure 5. Schematic representation of the operation of the automated reinforcement placement and tack welding system.

The starting point is a CAD file that is selected by the operator on an HMI (Figure 6).

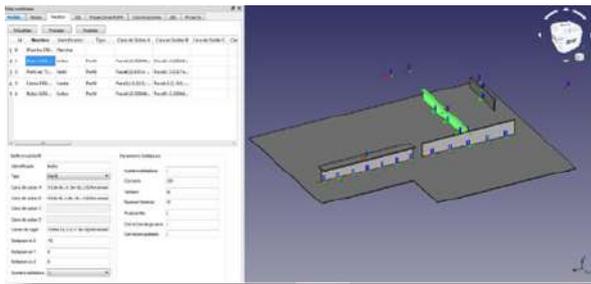


Figure 6. Matching CAD system interface.

The data of the base plate, reinforcements and profiles, as well as the information of the tack welding process of reinforcements and supports are stored in a database.

In order for the matching CAD system to have the necessary information to automatically solve the positioning and tack welding of elements, it is necessary for the operator to enter some information, inputs, such as the pick faces, the faces to be welded, etc. This information is stored in the database, and if the item is repeated in future previews, that information is available without a new process configuration

The system integrates artificial vision cameras to identify and locate both the base plate and the reinforcements or supports. To locate the base plate, two 2D vision cameras are placed on the gantry of

the welding robot (Figure 7), which first scans the worktable area to identify the position and orientation of the plate.



Figure 7. 2D vision cameras for base plate identification arranged on the cell portal.

On the other hand, stereovision technology was used to identify the type of reinforcement and its location in the baskets (Figure 8).

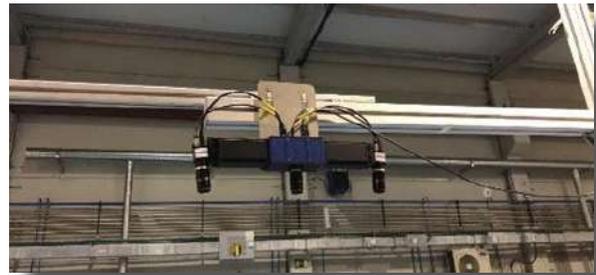


Figure 8. Stereovision cameras for identification of reinforcements and supports.

Figure 9 shows the matching process, both for the location of the base plate and the respective reinforcements in its basket. In the central image, the origin of the base plate is marked with a red dot on which the placement of the rest of the elements will be referenced.

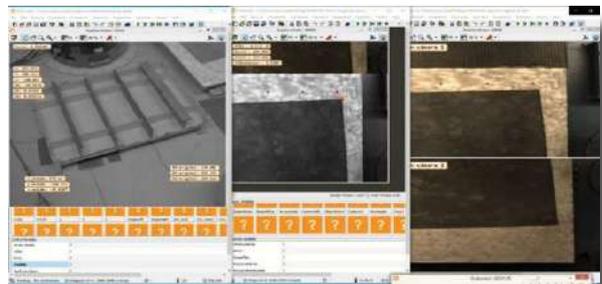


Figure 9. Matching for base plate location (from images taken with 2D cameras) and for reinforcements and supports (from stereovision).

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Once the gripping and positioning points of the different elements on the base plate have been determined, as well as the tack welding areas, the trajectories of the handling robot and the trajectories of the welding robot are generated, managing at all times their collaborative operation and avoiding any potential collision when operating in common work areas.

From the aforementioned HMI, the states of the different detection, manipulation and welding processes can be supervised, as well as stopping or resetting the process (Figure 10).

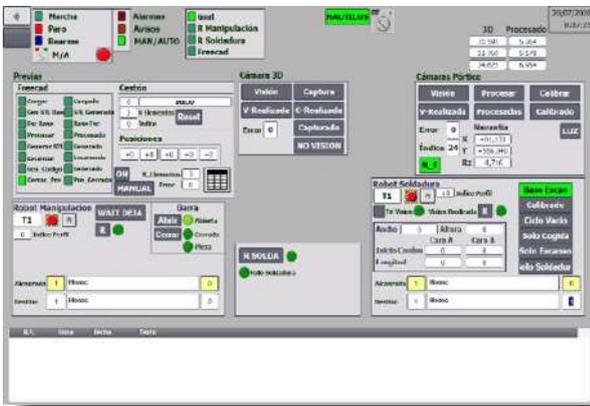


Figure 10. Supervision of the reinforcement placement and tack welding process through the HMI.

Figure 11 reflects different steps in the reinforcement placement and tack welding sequence in a demonstration performed at AIMEN. A video of the demonstrator can be viewed at the following link: <https://youtu.be/SFNTIBjzkz0>



Figure 11. Different steps in the manufacturing sequence of the demonstrator developed at AIMEN's facilities.

Demonstrator 2: Pre-assembly elements in sub-blocks

The second demonstrator focuses on the assembly and welding of the pre-assembly elements, such as pipe supports, electrical channeling, etc. These are elements that are incorporated into the sub-block at different stages and as long as the progress of prefabrication allows it. The objective is to install the largest number of armament elements of the installation in the inverted position of the sub-block, prior to turning it over.

The automation of support assembly is affected by the contour conditions associated with the assembly stage (free space, number of adjacent elements, elements to be considered in the trajectory, etc.), by the nature of the supports to be installed (one macro for each type of support), and by their location (flat panel, profile, etc.). For the purposes of this functional prototype, the following scenarios have been considered:

- Supports integrated by a metope and a profile welded on cloth
- Supports integrated by profile welded on flat panel

Figure 12 shows the design of the developed prototype.

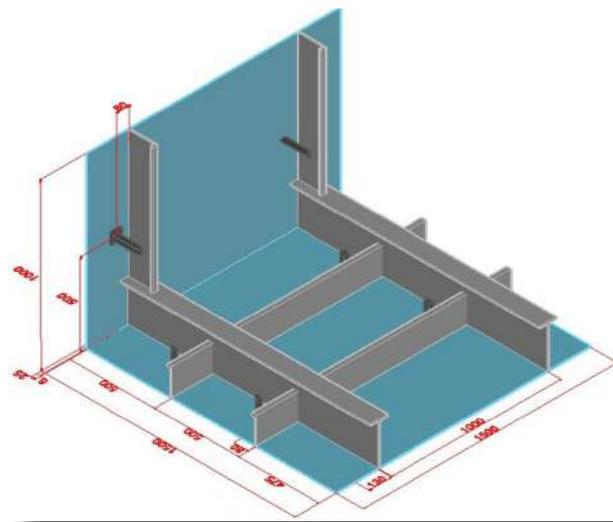


Figure 12. 3D model and prototype dimensions.

In order to make the prototype a reality, it has been necessary to develop and integrate diffe

rent system in order to locate its position in the working space of the pilot cell. The developed system is based on the use of 2D vision cameras and the use of targets integrated into the prototype.

Figure 13 shows the localization system based on 2D vision and calibration plate including the localization targets. IR illumination is used to improve ambient light immunity.

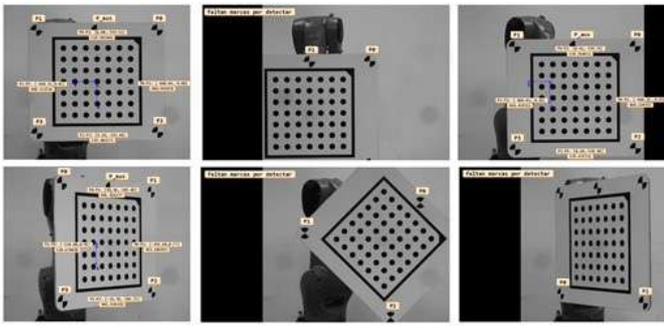


Figure 13. 2D vision system calibration process using calibration plate and targets.

Adjustment and parameterization tests of the GMAW welding process associated with the L, U and Metopes profiles also had to be carried out (Figure 14).



Figura 14. GMAW parameterization of a typology of support in AIMEN laboratories.

To ensure accessibility and avoid interference of the welding robot with the prototype reinforcements, it was necessary to develop a customized torch. (Figure 15).

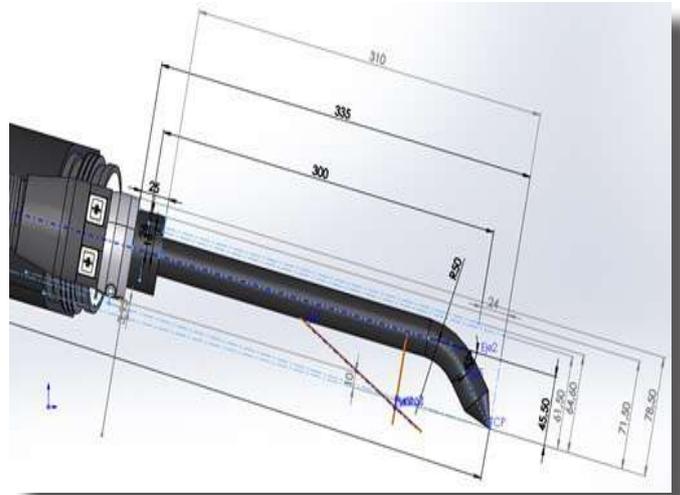


Figure 15. Custom welding torch.

Likewise, a flexible claw was designed and manufactured with the capacity to pick, transport and place the L and U profile models (Figure 16). This claw integrates a set of systems necessary for the correct assembly of the supports, namely: 1) Pneumatic system of parallel clamps required in the gripping of supports; 2) Distance sensor to ensure perpendicularity of the bracket during assembly. By rotating the robot claw using a rotation unit, the distance to the panel or bulkhead is measured and information is sent to the robot to correct its position; 3) Load cell for controlled assembly to guarantee the required gap.



Figure 16. KUKA KR240 r3330 placement robot and handling claw.

The process starts with the placement of the supports in a linear storage device (Figure 17). These supports are engraved with QR code, including information about their geometry. Through the use of a reading equipment integrated in a linear axis, the different models of supports are located in the store at the disposal of the assembly robot.



Figure 17. Media storage with QR reader.

To automate the assembly operation of the pre-assembly elements, on the prototype, the software based on matching CAD technology already used in the first demonstrator was used (Figure 18).

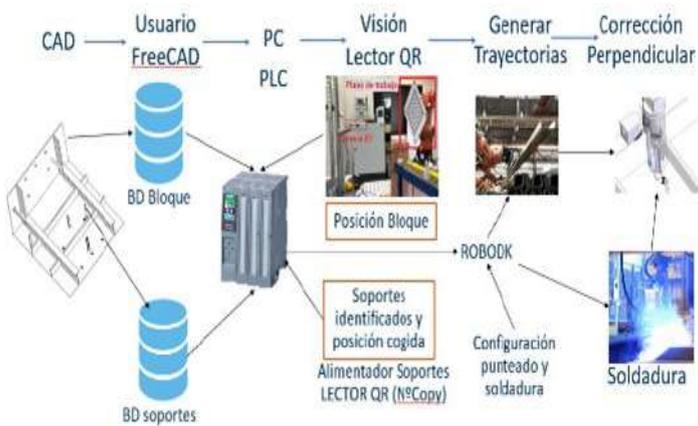


Figura 18. Diagrama de operación del sistema matching-CAD.

As previously mentioned, the system incorporates machine vision cameras to identify and/or locate the position of the prototype. To locate the prototype, two cameras with 2D vision and IR illumination are incorporated on the cell gantry, so that one of the cameras (zenith) locates the base plate and the other (lateral) would locate the bulkhead.

Once the gripping and positioning points of the supports have been determined, as well as the tack welding areas, the trajectories of the robot for handling the elements and the trajectories of the welding robot are generated, avoiding possible collision situations.

Figure 19 shows the interface of the matching CAD system generated in FreeCAD environment, where all the steps to be followed to generate the handling and welding trajectories of the robotic system are shown.

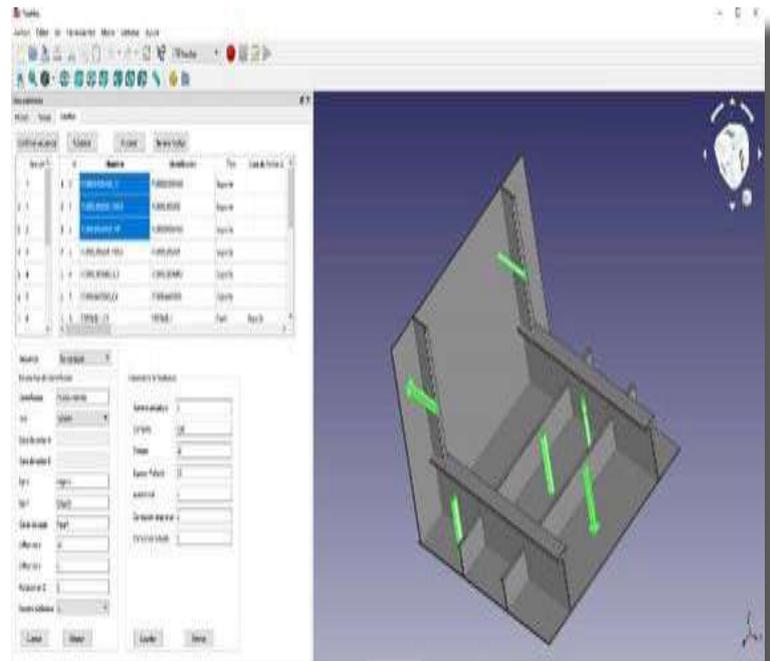


Figure 19. Configuration application in FreeCAD environment.

Finally, Figure 20 shows different phases of the process in the prototype cell for assembly and welding of supports, as a result of the integration of the different technologies developed. A complete video of the demonstrator can be viewed at the following link: <https://youtu.be/siYmeuSDL>



Figure 20. Different phases of the bracket assembly and welding process.

Conclusions

Within the framework of the NAUTILUS project, it has been possible to validate a series of technologies for the robotization of the assembly and tack welding of component assembly and pre-outfitting elements. In addition, a series of critical points and possible solutions for the development of a future installation for some of the applications have also been identified. In this sense, it should be noted that demonstrator 1 will be continued in 2022 within the Industry 4.0 “F4ST” initiative, also in progress and in which NAVANTIA and AIMEN are also participating, for the assembly and dotting of elements in pre-fabricated elements. The objective within the framework of F4ST is to develop a pre-industrial scale solution.

Acknowledgements

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Nuevos materiales y sistemas automatizados para
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OT 1. “Promover o desenvolvemento tecnolóxico, a innovación e unha investigación de calidade”

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Detegasa applies Augmented Reality to digitalize its know-how

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The Challenge

With globalization of the naval industry and a constantly changing market, companies in the naval sector continue to bet on innovation as a way of adapting to these changes; and this is what Detegasa is doing.

This project is part of an ambitious strategy to increase competitive advantage, in regards to enhanced transfer of internal know-how, as well as providing a better technical service while cutting back on qualified staff travel costs.



Solution

To face this challenge, they partnered with XOIA Extending Reality as technological experts on incorporating KETs such as Augmented Reality (AR). In this case, AR acted as a tool for innovation in the visualization of technical manuals.



The implemented tool allows the company, in an autonomous and simple way, to generate step by step technical manuals through a 3D editor. Later you can visualize them in augmented reality on top of the machine itself through an app for smartphones, and Hololens 2 mixed reality glasses.

Thereby, Detegasa's clients have autonomy when carrying out operations on the machines, even if they have no experience. In addition, Detegasa saves costs in the international travel of its expert technicians for the set-up and maintenance of the equipment.

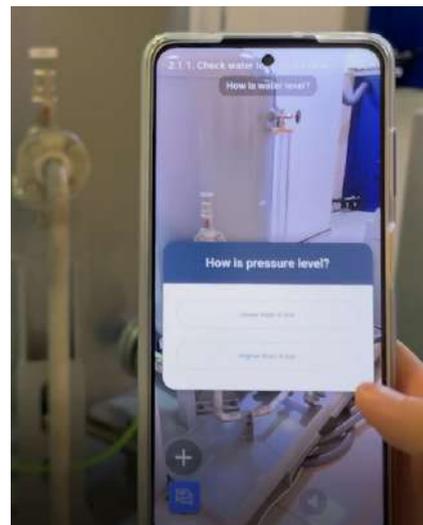
Operation

This tool combines two systems. A **cloud platform**, accessible from anywhere, where all content is managed and hosted, including: machines, users, category creation and a document repository. And the **augmented reality app**, whose objective is to facilitate the operation, start-up and maintenance of the equipment supplied by Detegasa for the end user.

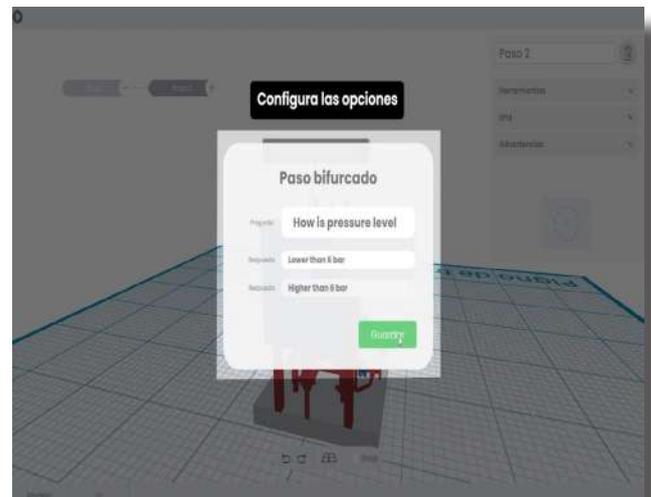
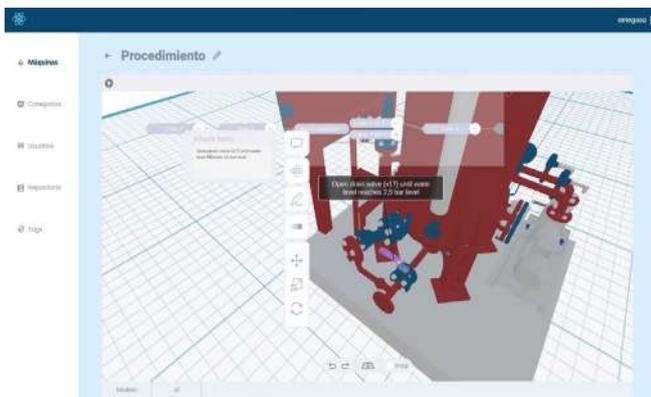
With regard to machine management, within each team, procedures can be created and grouped by categories.



This step creation system adapts to any workflow, since it incorporates the "multiple step" option that allows you to add a multi-response questionnaire. This functionality allows the operator to be directed to one step or another when faced with a situation conditioned by variable data, such as temperature or pressure. Thus, with something as simple as answering a question, the user can proceed to the next appropriate line of steps based on their answer.



In addition, the platform contains a 3D editor where you can create step-by-step 3D instructions on the machine itself. Using a 3D model of the machine, it is possible to select components and perform various actions on them: set animations, highlight parts, associate notes, move, etc.



Besides, the editor allows the incorporation of technical documentation, images such as screenshots of the HMIs and even notices of various kinds that could be necessary for the execution of the processes such as warnings, use of PPE or necessary tools at each step.

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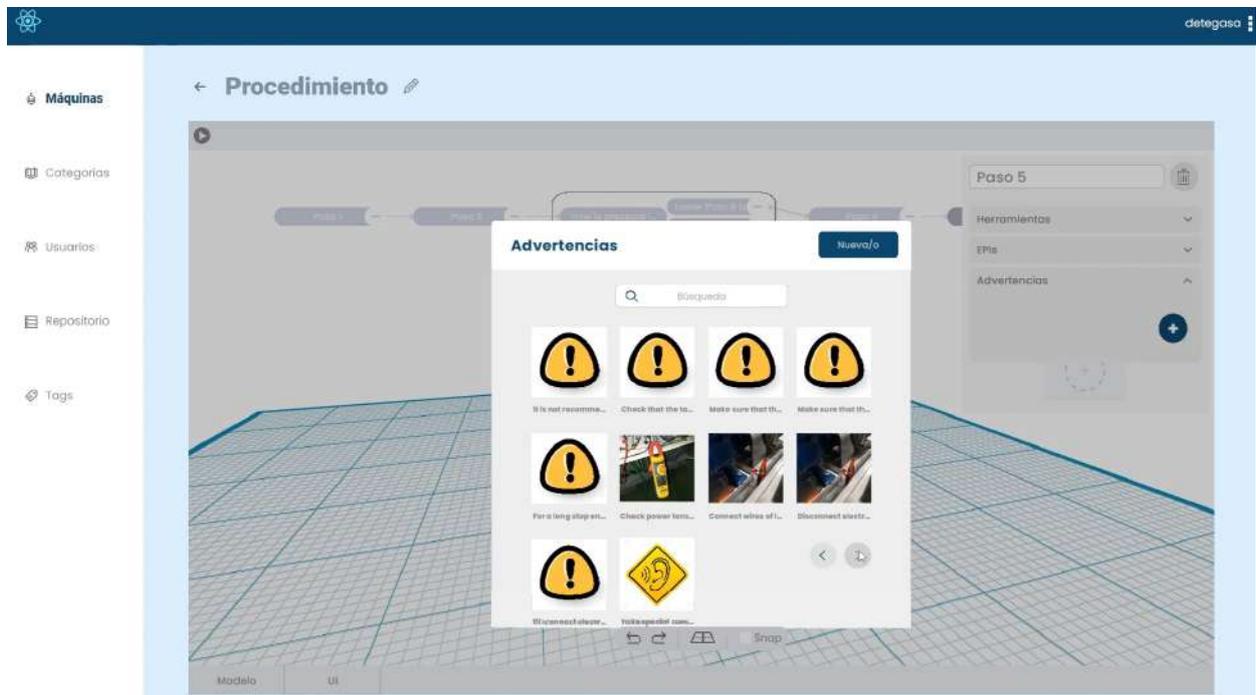


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The second system, as we mentioned before, is the augmented reality app. This app is cross-platform and is available for mobile devices (Android and iOS) and mixed reality glasses (Hololens 2). Thereby, the application can guide the operators on the work environment itself, indicating step by step how to accomplish different procedures



The advantages of having developed a system compatible with various devices are the following:

- Mobile app: this version, since the acquisition of the devices is cheaper, makes it more accessible for companies. In addition, the learning curve for using the tool is easier since the use of the smartphone is more widespread in the day-to-day of workers.
- App for mixed reality glasses: in the case of Hololens 2, the system has been adapted so that the user's interactions are done with the hands through gestures. This modification in the use of the tool increases the comfort of the users since this way they have total freedom to work with their hands without having to hold any device.

It should be noted that in both versions, a method of automatic recognition of the equipment has been developed, which facilitates the work of the personnel. For this to work, the prior synchronization of the 3d model of the machine with the real equipment is necessary. Once this is done, the application generates a point cloud to anchor the virtual model to reality. Thus, every time you want to view a procedure, just by scanning the real machine with the application, it places the instructions in augmented reality, automatically on top of it.



problems on board and guarantee the independence of the system.

Goals

To consolidate the implementation of the tool, Detegasa is going to add new equipment and procedures, with the aim of migrating from pdf manuals to the augmented reality system.

The objective is that the platform becomes the place where the company's technical know-how is centralized, to facilitate its transfer and accessibility, from anywhere in the world.

As mentioned above, the goal of the augmented reality tool is not only to facilitate the maintenance and start-up of the equipment or transfer knowledge to your customers, but also to save on travel costs for qualified Detegasa's personnel. Thereby, it is possible to avoid the intervention of the Detegasa's team since the client has a tool that gives them autonomy to solve specific procedures.

Conclusions

With the implementation of this revolutionary tool, Detegasa goes a step further in the factory of the future and industry 4.0, becoming a pioneer in the transfer of know-how and the implementation of augmented reality as a work tool for daily use.

Last, at the connectivity level, the context of use of the tool has been taken into account: a ship where connectivity is usually scarce or non-existent. For this reason, the AR application allows the procedures to be downloaded and hosted on the device itself. This is intended to avoid possible connectivity



Despite everything, Logistics Networks are working

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MARITIMA**CONSIFLET**

Logistics has recently become a major strategic factor for companies and they are now showing a renewed interest in their supply chain. Reliability, freight cost, transparency of operations and responsiveness are now keys to their competitiveness.

There is no longer any doubt that the Covid-19 pandemic has changed the way we relate to each other, the way we work, the way we shop, etc. The traditionally well-oiled supply chain has broken down as a result of confinements, disruptions to shipping lines, reduced manufacturing capacity and a lack of equipment and space on ships to transport them.

WE HAVE MOVED FROM "MAKING THINGS" TO "BUYING THINGS"

The pandemic has pushed families to save, confinement has reduced spending and filled us with doubts about the future. In short, it changed the way we spend. This change in lifestyle has had a major impact on the current global shipping crisis.

Before, we spent part of our money on buying services, travel and leisure. When we were confined to the house we stopped "doing things" and switched to "buying things". Suddenly we found ourselves with money saved and with new needs – we spent more time at home, we worked from home and so

we decided to change the TV, the fridge, the sofa, the console, the chair for remote working, the bicycle to move around freely, etc. This change in social habits triggered the demand for durable goods and there was insufficient supply on the other side to satisfy it.

An unprecedented international supply chain crisis was triggered. One only has to look at the numbers of the purely importing countries to see the increase in import figures, the real source of the current shipping crisis. In the USA alone, the volume of imports by container increased by nearly 20% from June 2020 to July 2021, an increase of such a calibre that it helps to explain the evident tension in the global logistics system that we have not yet been able to digest.

ARE WE CHARTERING SHIPS OR SPACE TRAVEL?

In addition to the change in consumption trends, a number of other reasons drove freight rates through the roof. Not only container ships carrying

dragsa IIoT Platform

Dragsa is our digitalization platform, formed by different modules. Each one in charge of a specific task, making a perfect and efficient combination.

These are some of the modules: **nido** is the responsible for user interface, **ikol** is a real time control system including augmented reality, or **skuld** which is in charge of the predictive models, making Dragsa a precise and effective tool.



ikol
crane



ikol
crane AR

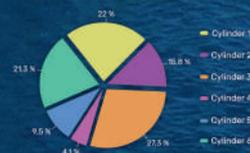
Digital Solutions for Naval Industry



Predictions



Monitoring



Charts

- Deviation 1
- Deviation 2
- Deviation 3
- Deviation 4
- Deviation 5
- Deviation 6
- Deviation 7
- Deviation 8
- Deviation 9
- Deviation 10

Alarms

surcontrol

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Watch the video



consumer goods but also general cargo, dry bulk, liquids, etc, cargo ships were infected by the sector's upward fever.

And 2022 arrived, which started as 2021 ended with freight rates rising but with slight fluctuations. Although tonnage hunger remains noticeable across all vessel sizes and types, supply is expected to remain slow for the time being since there is no immediate influx of new container units and the supply of bulk carriers is limited.

The new year is opening with fluctuations in the market, which have affected all sizes, and this is giving charterers hope of beginning a period of lower freight rates which will at least allow them a small respite from the economically suffocating 2021. However, we will have to wait to see whether these declines will be the trend or whether it has just been a false sensation brought on by these (Chinese New Year) holidays.

Fuel prices have also gone crazy. Since 17 February and in just two weeks, the world average price of VLSFO has risen from an already high \$769.50 per tonne to \$885.50, the cost at the same time in 2021 being \$525.50.

The escalation in fuel prices is passed on to carriers and therefore fuel surcharges are expected to rise. Even so, with Asia-Europe rates already at \$13,495/TEU as an example, the fuel component is a relatively small part of the total cost.

INFLATION, WAR, TRADE INTERRUPTIONS

2022 was expected to be a continuation of 2021, with high freight rates but with a tendency to stabilise the escalation. But inflation soared, a war with unforeseeable consequences was declared and the price of oil escalated.

Companies have inflation as a strategic priority and see expectations that the increase in freight rates would be transitory. Analysis of the annual accounts of companies in the S&P index shows that the term "inflation" was mentioned in 71% of material events in the fourth quarter of 2021, up from 39% a year earlier. The same was true for the term "supply chain", which was mentioned on 78% of occasions compared to 53% in the same period of 2020. Companies are no longer concerned only about costs but also about how to be able to pass these costs on to their clients while ensuring that deliveries are made within the schedule agreed in the sale agreement.

The conflict in Ukraine adds additional stress to supply chains and commodities from Ukraine (mainly metals) and Russia (metals, precious metals, gas and oil). So far, spot rates for sea containers from Asia to Europe and the US have not increased as a result of the war in Ukraine and the ensuing boycott of Russian shipments by several maritime carriers.

As Russia-bound cargo stops moving, maritime traffic congestion worsens and available capacity decreases. A direct consequence may be an increase in maritime traffic between Asia and Europe to the detriment of Russia and additional available capacity for Europe (except Russia) and the United States.

The disruption of trade due to the war has caused transshipment delay times to increase by 43% across Europe since 17 February.

HOW TO NAVIGATE IN THE CURRENT CHARGING ENVIRONMENT

Importers and exporters around the world are wondering how long they can wait for transport rates

and space availability to come down. The answer is - not yet.

But beware, nobody stop! World trade continues to grow, as shown by the fact that in 2021 it reached 28 billion dollars, 13% more than in 2019, or that US maritime imports grew by 6.9% annually in February.

Some recommendations

- Anticipation is the best way to ensure on-time delivery.
- Explore the possibility of warehousing in strategic locations closer to the final destination of the goods.
- When pricing products, take into account the instability of the moment and the volatility of transport prices.
- Assess the possibility of air transport to ensure deliveries, despite its cost.

That the environment has changed is a fact, as is the fact that we have to adapt (if we have not already done so) to the new situation. Despite everything, logistics networks are running at full speed.



The Sea Cloud Spirit of Metalships & Docks, outstanding Shipbuilding of the year 2020 in Spain

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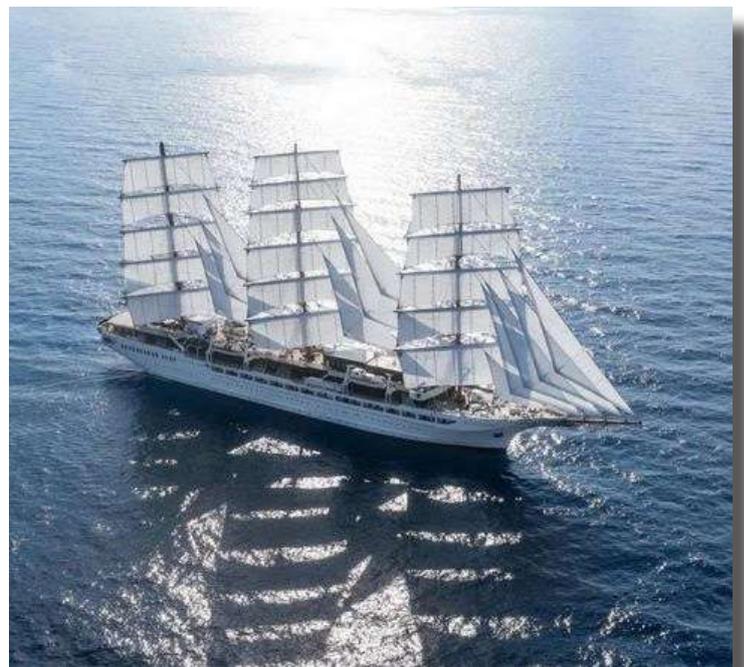


The frigate Sea Cloud Spirit, one of the largest sailing vessels in the world, built by Metalships & Docks for the German company Sea Cloud Cruises, was chosen by the readers of the website www.ingenierosnavales.com as the Outstanding Shipbuilding of the year 2020 in Spain. Given by the Association and the Official Association of Naval Engineers since 2010, the prize is awarded by popular vote on the web, being the first time that this shipyard from Vigo is the winner. The Sea Cloud Spirit takes over from the passenger catamaran Krilo Lux after beating the other finalist, the catamaran Mundo Marino ECO of Drassanes Dalmau.



The construction of the Sea Cloud Spirit is a story not without its problems. The project began in the old shipyard of Factoría Naval de Marín in 2008, with an investment of 65 million euros and following the project of the naval engineer Iñigo Echenique. The crisis hit the shipyard hard and in 2010 it filed for bankruptcy protection. The Sea Cloud Hussar, the original name of the vessel, remained in the yard's slipway until the sale of the shipyard to Nodosa. The unfinished vessel passed into the hands of Bankia, which in 2015 moved it to Rodman's facilities in Meira. In 2019 it was taken to Metalships, and once the shipowner obtained the necessary credit for its completion, work continued.

The Sea Cloud Spirit is manned by 85 people, 40 of whom will be dedicated exclusively to sailing navigation. Designed in compliance with all environmental standards, the vessel offers its passengers an elegant and cozy ambiance that replicates the interiors of classic vessels, as well as the possibility to enjoy on board a luxury restaurant, wine cabinet, library, a spa area with hairdressing salon, a gym with sea views and wide open spaces on the deck. The vessel joins the fleet of the exclusive German firm, which also owns the 1931 Sea Cloud and the 1999 Sea Cloud II, also built in Spain by Astilleros Gondán. If you are thinking about a passage on the Sea Cloud Spirit, prepare your wallet, because the price for a ten-night journey in the Mediterranean is around 12,000 euros.



With a budget of up to 90 million euros, the result is a spectacular sailing vessel of 136 meters in length and 17.2 meters in beam, rigged as a frigate, with three masts and 27 sails that total a surface area of 4,165 square meters, while four 1,280 kW Man diesel generators and four 1,200 kW Siemens electric motors allow it to reach a wind speed of 14.2 knots without wind. The vessel has the capacity to accommodate 136 passengers in 68 cabins, who can choose from six cabin options, from the Master Suites of almost 40 square meters that include a private balcony of 7 square meters and that in addition to the bedroom are equipped with a sofa area or a bathroom with an oversized bathtub, to the single cabins of 13 square meters and with only a small porthole to the outside, through the Junior Suites of 25 square meters and that include all the amenities of the Master Suites, the De Luxe Lido or De Luxe outside cabins, or the Superior Outside cabins.

MAIN CHARACTERISTICS

- Length: 138 m.
- Beam: 17,2 m.
- Draft: 5,65 m.
- Height of mast above deck: 57,7m.
- Sail area: 4,165 m²
- Passengers: 136

Shipbuilding ecological and energy transition: a strategic proposal for the Galician Shipbuilding Sector

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What I'm presenting in this article is a proposal for a future strategy for the Galician Shipbuilding Sector. As you all know, the three major transition aspects we have to face in the Shipbuilding Sector are: the ecological transition, the energy transition, and digitalization. As it could not be otherwise, the recently approved naval PERTE will contribute to the naval industrial autonomy of Spain and Europe, and will enhance its diversification and its sustainable, technological and digital development.¹ To achieve these challenges, five objectives have been set: (1) maintain this sector's contribution to industrial sovereignty; (2) **diversify activity toward marine renewable energies**; (3) **digitize the value chain**; (4) **increase environmental sustainability**; and (5) improve employee education and training.

In this article, I will address a strategy focused on the ecological transition and the energy transition, with the digital component being a transversal enabling technology for both transitions. The reason for this view is that there is a difference between "what is manufactured" and "where it is manufactured". For this reason, I am not going to address the eco-design of vessels or marine artifacts or IoT technology or digital twins of ships as it is a field that I do not master and that I believe is appropriate to be addressed by other experts. The article's vision is to build, repair, and scrap vessels with the least possible environmental impact on the territory and with energy security at reasonable prices in the coming decades to ensure a sustainable, efficient, and safe

activity for people and the environment.

Climate change and sustainability are two terms that appear systematically in almost all official documents in recent years and have become so important that, as you all know, financing options today require an exhaustive analysis of the environmental damage that an activity may cause, and as established by the European Commission for the application of the DNSH Principle within the Sustainable Finance Strategy.²

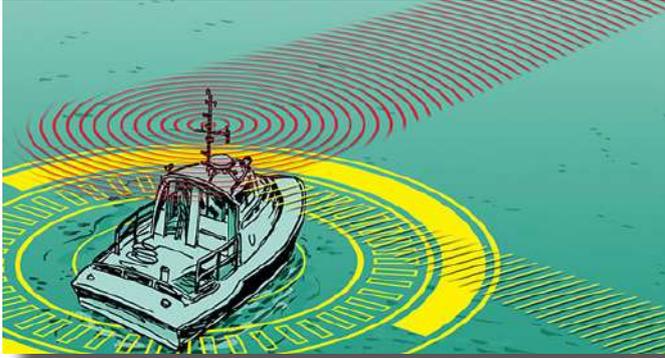
Let me establish the scope of each of them before going into the subject of the article.

Climate change is the global variation of the Earth's climate. This variation is due to natural causes and to human action and is produced on all climatic parameters: temperature, precipitation, cloudiness, etc., at very different time scales. There is currently an almost widespread **scientific consensus** around the idea that our mode of energy production and consumption is generating a global climate change, which will, in turn, cause serious impacts both on the earth and on socioeconomic systems.³

In short, climate change **is an effect of the pollution caused by the production model and the way of life** on the atmospheric system.

However, **sustainability** refers, by definition, to the satisfaction of current needs without compromising

the capacity of future generations to satisfy theirs, ensuring a **balance** between **economic** growth, **environmental care** and social welfare.⁴



Therefore, and given the consensus that exists around the generalized contamination of the planet, whether with waste, spills, or atmospheric emissions, we can assert that **the industrial system that sustains economic growth is not sustainable** since it neither preserves the environment nor has it brought social welfare to the majority of the world's population. Broadly speaking, this is the framework in which we find ourselves and on which we can act.

I cannot ignore the implication's analysis of the **financing** approved in the framework of the 2030 Agenda (SDG) and the Paris Agreement. The key aspect of the funding is the "environmental damage"; let me explain: The **RECOVERY, TRANSFORMATION AND RESILIENCE PLAN (PRTR)** only allows funding for actions that respect the **DNSH principle**, "do not cause significant damage" through 6 environmental objectives: (1) Mitigation and (2) adaptation to climate change, (3) sustainable use and protection of water and marine resources, (4) Transition to a circular economy, (5) Pollution prevention and control and (6) Biodiversity and ecosystem protection and restoration.

And what can the shipbuilding industry do to improve sustainability? The answer is not simple, but it is economically viable not because the cost is low, but because the return is almost immediate.

Let's start. There is a tool that every day that passes acquires greater value in decision making for almost any board of directors, and it is none other than the **life cycle analysis (LCA)** that together with the cost analysis can transfer the environmental impact of any organization in all its magnitude to its cost struc-

ture and therefore economically make visible costs that otherwise could not be visible.

The LCA is an environmental management tool whose purpose is to objectively, methodically, systematically and scientifically analyze the environmental impact caused by an organization/product during its entire life cycle (this is from cradle to grave). It is therefore an ideal tool to (1) **guarantee compliance with the DNSH principle** as it systematizes the analysis along the value chain of a product, for example a vessel, a jacket or any other marine artifact, (2) **establish**, through its continuous use, metrics of objectives to be achieved and therefore be included in **dashboards** and (3) **make visible the impact on the value chain** and therefore is of great help to **comply with the SDG** on which the organization can act, (4) **provide knowledge on priorities in strategic product planning**, (5) serve as tools for the **design of marketing strategies** based on green and sustainable values, and last but not least, (6) establish a baseline from which to act to evolve environmental management from an approach of environmental improvement actions focused on a single stage of the product life cycle (impact reduction of the manufacturing process) **to an integrated approach of the entire product life cycle**, that is, **ecodesign**.

Using LCA continuously, it is possible **to simulate**, for example, possible changes in the use of raw materials in production, giving the necessary information to implement the proposed improvements, evaluating the environmental benefits to be obtained before implementing them.

What are the other benefits of applying the LCA approach?

To the aforementioned which ensures compliance with the DNSH principle, and therefore gives access to apply for grants under the PRTR, the continued use of the LCA aligns the organization/product with practically all the European and national policies from which they all drink, regional plans, programs and strategies with environmental implications; among others, the LCA guarantees to align the organization with the objectives of the **Circular Economy**, the fight against **Climate Change**, the European **Zero Pollution Strategy**, the roadmap for the sustainable **use of natural resources** or the next Roadmap for the **sustainable management of mineral raw materials** currently on public display at

MITERD⁵, **Carbon Footprint and Water Footprint**; all this while manufacturing or providing the same services as always, but in a more efficient and innovatively manner.

In short, the LCA is a transversal tool; any organization that wants to **include sustainability in its vision** has in the LCA the ideal tool to measure and evaluate the steps taken towards the reduction of the environmental impact of the organization.

Therefore, the first leg of a future naval strategy on the ecological transition should be based **on a life cycle analysis and its results, to establish through a strategic plan for the ecological transition of the Galician naval sector some objectives and measures** to be implemented to achieve full sustainability in a time horizon that should be between 2040 and 2050.



On the other side, the second of the legs would be energy, and here the strategy is different than with the ecological transition. It is not a question of measuring our energy efficiency, which is undoubtedly important, but of achieving a certain stability in terms of supply and consumption at reasonable prices.

In this case I focus on two concepts; on the one side the concept of **local energy community** and on the other **offshore energy** where the naval and its infrastructures will be basic for its development and subsequent distribution.

Order TED/1446/2021 of December 22 establishes that an energy community is a **legal person based on open and voluntary participation, effectively controlled by partners or members who are natural persons, SMEs or local entities, which develops renewable energy, energetic efficiency and/or sustainable mobility projects that are owned by such legal entity and whose primary purpose is to provide environmental, economic or social benefits to its partners or members or to the local areas where they operate, rather than financial gain**⁶.

The approach proposed here is **to attend a renewable energy auction through the figure of a local energy community to produce, consume and sell energy, without its members losing their status as final consumers.**

And why attend a renewable energy auction?

The importance of the auctions can be understood by looking at the results of the last renewable energy auction adjudicated. The weighted average price for photovoltaic was **24.47€/MWh**, with a minimum of 14.89€/MWh and a maximum adjudicated price of 28.9€/MWh. Figures very similar to those of wind power, with an average price of **25.31 €/MWh**, a minimum of 20 €/MWh and a maximum of 28.89 €/MWh. With these results, there is no doubt about the benefits of auctions to **obtain renewable energy at very cheap prices.**

Obviously the costs of onshore and offshore wind generation are significantly different; according to ETIPWind Roadmap costs have dropped in recent years from 150 €/MWh to 65 €/MWh and a further reduction is expected in the coming years. Taking into account the time required to obtain licenses and administrative permits plus the construction phase of an offshore wind farm, we can be talking about starting operations no earlier than 2027 ?

It is also important to bear in mind that local energy communities are not for-profit entities, but are entities with social and environmental purposes. This means that after consuming energy at more than reasonable prices, the benefits derived from the sale of energy must be applied in the territory through social and environmental measures. For me, one of the social improvements that can be derived from the generation of offshore energy by the shipbuilding sector would be to offer to the shipbuilding workers the supply of energy at much cheaper prices than those we see today in the market as a labor improvement, which would help both to create loyalty in the labor commitment between company and worker and to attract specialists who today leave the shipbuilding sector to other sectors that guarantee them better working conditions.

1.- <https://cutt.ly/zSLH3Bp>

2.- <https://cutt.ly/uSLJHWr>

3.- <https://cutt.ly/USLKjIZ>

4.- <https://cutt.ly/qSLKCU1>

5.- <https://cutt.ly/5SLLdKX>

6.- <https://cutt.ly/5SLLGve>

7.- <https://cutt.ly/GSLZEnZ>

Additive manufacturing present and future, status and challenges

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Additive manufacturing is currently changing the manufacturing market and its players, and several changes were made e some more is a planned in a near future. So, how is the industry changing and adapting? Where lie the main challenges: technology, personnel, processes, recognition?

EWF alongside its members has been a keen player promoting the knowledge to facilitate some answers to these questions. For the last 5 years, EWF has been active with AM market and several stakeholders to promote the development and use of standards and best practices guidelines and the development of professional profiles and the delivery of training in a harmonized and recognized system across Europe.

Stakeholders from producing industry and machine manufacturing strive for new standards that regulate Additive Manufacturing activities. Although many were initiated or revised thought the last couple of years, a lot of work is still to be done. AMable project partners and experts, in collaboration with several experiments and SMEs, have identified recurrent needs in standardisation and compiled a list that compares the identified standard needs to the existing standards. It therefore also provides information about specific gaps and if those are presently being considered by any technical committee. This list allows all stakeholders from production companies to equipment providers to see if it is worth waiting for a publicly disclosed standard or if it is time to engage.

AM technologies are evolving at a much faster pace than the development of the skills to use them. That is why the industry demand for a skilled workforce must be fulfilled by identifying real needs using a strategic approach and ensuring a methodology that guarantees continuous knowledge updates. The focus will concentrate on analysing and identifying expected technological breakthroughs until 2030 which can be assigned to the following 3 segments, chosen due to a previous division done by ISO and ASTM according to currently available standardization documents:

1. Materials
2. Process/Manufacturing
3. Post Processing

The future of AM is bright and is an increasingly important pillar for the future manufacturing industry. Currently, there are an increasing number of use cases and demo businesses showing the benefits that AM can bring as mainstream manufacturing technology. There are several technological trends in material, technology, post-processing, ICT and quality assessment fields that will bring innovations in the coming years to deal with current AM challenges and industrial needs. Along with this technological and industrial plan, specific roadmaps in AM were compared to identify the most promising technological challenges. The conclusion points out a list of main trends which can determine the evolution of these technologies and have a direct influence on skills development in a short (2020-2021) and

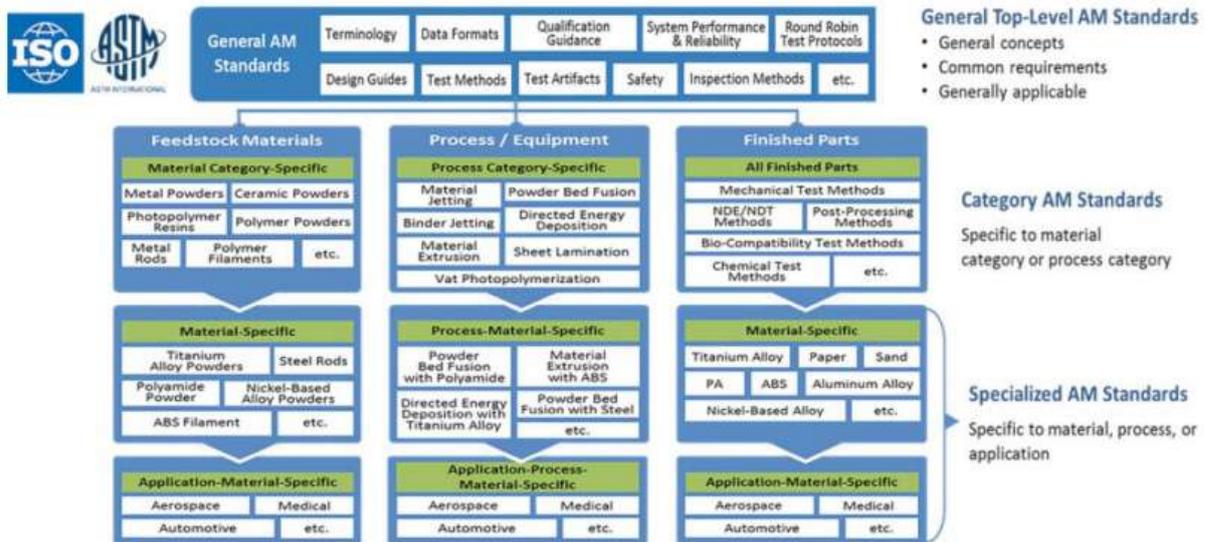


Figure 1- Top Level AM standards defined by ISO and ASTM

long term (2022-2030) period in the field of AM. For more detail, please consult SAM project.ⁱⁱ

But still, the future of the workforce for AM industry has a few challenges as strengthening the link between the industry players and the training centres, tackling the lack of AM personnel and the readiness of all the involved organizations to collaborate to mitigate the gap in training and the existing diversity of solutions and practices. These challenges in more detail need to find answers to the following topics:

- AM educational provision focus on higher qualification levels (e.g. EQF levels 6 to 8), with very little training, offers at the vocational level for EQF levels 4 and 5
- The lack of training facilities with ready access to AM equipment is hampering the provision of education and up-skilling
- The lack of competence and knowledge of the training staff also influences why training centres cannot provide training
- The growing use of AM technology in the industry is increasing the demand for AM workers, but the offer doesn't match the existing need, thus generating high competition for a skilled AM workforce
- Absence of concerted actions in terms of possible synergies between institutions to overcome the lack of equipment in training institutions

- Lack of data regarding the number of job offers and current positions in AM, creates increasing difficulties in providing a targeted/matching training offer and may cause an unbalance between training offers and the needs of the market
- The lack of competence and knowledge of the training staff also influences why training centres cannot provide training
- There is a lack of a harmonised approaches for training involving different sector stakeholders to address the skills development programmes focused on sector-specific needs in AM
- There are not enough skilled professionals available to meet the demands, and especially to operate across sectors
- There is a lack of combined approaches involving stakeholders from different sectors including standardisation bodies, educational and industrial councils to develop relevant qualifications to educate the diverse workforce of AM professionals to meet sector-specific requirements
- There is a sharp rise of new processes or the evolution of "old" processes, also the quick adaptation of needs in terms of automated post-processing technologies
- New topics will enter the market such as cyberse-

curity, multi-materials, machine learning and printed electronics

- The continuous watching of the market while using a strategic approach to cover the most important trend is required

The mind map pathways for skills development in AM follows the AM Value chain flow, meaning that the set of skills required by each Professional Profile is grouped according to the specific AM value chain segments (e.g. Modelling & Design, Materials, AM Process, PostProcessing, Product and End of Life).

Prior findings, supported by ongoing validation sessions to align the Occupational Standards with industrial requirements, lead to the development of Metal AM Professional Profiles and skills for the AM Process Engineer, AM Designer, AM Inspector and AM Operator levels. These AM Profiles and Skills for each Professional Profile and qualifications are composed by a set of Units of Learning Outcomes / Competency Units (CUs) with different proficiency levels (e.g. Independent, Specialised, Advanced and Expert) in alignment with the correspondent Professional Profile which enable the progress inside one or different qualifications, thus fostering up-skilling (improving existing skills) and re-skilling (training in new skills).

In a conclusion this Skills Roadmap developed under SAM project has outlined the complex challenges that the AM sector currently faces, in the form of “Gap drivers” (challenges) between what the industry needs in terms of educational/training offer and what is currently available, thus placing forward key strategic initiatives and concrete activities to address each of the main seven strategic objectives:

- Strengthen the collaboration between industry and training organisations.
- Tackle the lack of AM personnel at the European level.
- Prepare European, National and Regional organizations to tackle the challenges of AM, in terms of Qualified personnel.
- Tackle the diversity of sectors and applications of AM
- Constant update of the AM European workforce.

- Prepare the future workforce.
- Leverage on existing funding programs and mechanisms.

To address this fast and challenging path forward the AM Observatoryⁱⁱⁱ is putting in practice a methodology for a smart, sustainable and inclusive growth of the Additive Manufacturing Sector in Europe, providing updated information on AM skills needs shortages and mismatches and on technological trends and monitoring a broader scope of AM related initiatives, which are in demand by the labour market within the European and National landscapes.

SAM’s skills strategy until 2030, outlines the sector needs and identifies a set of implementation activities towards AM skills development in Europe. The Strategy includes:

- Description of Key Challenges of the AM Sector, named “Gap Drives”;
- Establishment of Strategic Objectives and outline of supporting actions and implementation activities put forward by SAM implementation and beyond;
- Mind map of the AM Skills Roadmap representing the required Professional Profiles, Qualifications and Skills linked with the AM value-chain, materials and processes.

AM is at a fast pace changing technologies, materials, processes, ways to manufacture and demanding new professionals, with new skills. This is both challenging and energizing and will have ramifications across several markets, a few European initiatives are helping this transition and growing and EWF is proud to take an important role.

Please follow us at www.ewf.be^{iv} and don’t miss out the 1st Annual International Additive Manufacturing Conference: <https://www.ewf.be/events/i-am-2022.aspx> held in Lisbon, October 2022, organized by EWF and ASME.^v

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- i) www.amable.eu
 - ii) <https://www.skills4am.eu/theproject.html>
 - iii) www.cordis.europa.eu
 - iv) www.ewf.be
 - v) www.asme.org

Interview with: Dámaso Bueno // Director of:

BOTAMAN (Boteros Amarradores del Noroeste S.L.)

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Botaman es una empresa de



Today we interviewed: Dámaso Bueno Ramírez, Captain of the Merchant Marine and Manager of BOTEROS AMARRADORES DEL NOROESTE S.L. (BOTAMAN). Company dedicated to port mooring services in the Port of Ferrol; assistance to ships (supplies and provisions); support and assistance services to shipyards (seamen, qualified professionals, and mechanical assistance); lashing and pollution control services (coastal cleaning, spills, and waste management in ports).

Their wide experience in the port industry allows them to offer port services tailored to the port, being a benchmark in the sector and incorporating knowledge, technology and latest generation solu-

tions. In addition to betting on safety for crews, the environment, and equipment, which are a basis for its operations.

- What is the origin of BOTEROS? Do you continue to maintain the original lines of activity, or have you diversified your activity?

The company originally came from a repair workshop created in 1968. In 1996 a series of activities were combined and Retrasub S.L. was founded, dedicated to the mooring and unmooring of boats, underwater recoveries, scrapping, etc. In 2006 Botaman appeared, formed by partners from the

Ferrol area, which was bought by the Reyser Group in 2008, and was already dedicated mainly to the mooring and unmooring works. Since a few years ago, in 2018, the group was bought by P&O; so today Botaman is one more company of the P&O Reyser Group. Large multinational dedicated mainly to the mooring, towing, and assistance to platforms throughout the world.

At the end of 1992, with the entry into force of the State Ports and Merchant Marine Law, the business began to be regulated by the Administration and experienced a significant change. Put into practice, it meant that companies had to meet very specific requirements in terms of boats, personnel, port vehicles, etc. What does this lead us to?: to the fact that the companies dedicated to this activity lost some freedom and became very subject, with little flexibility in their actions; even the maximum tariffs were fixed... for example, these can only be revised if the changes in conditions are very severe and unfeasible at the business level.

Basically we continue with the same activities, we do the same, but before the Ports Law the work with the shipyards was a very important part. Today we continue collaborating, but in a more limited way, we do entry assistance work, seamen's work, etc., but our main activity is that of boatmen. The law requires scrupulous compliance with the specifications and this makes it more difficult to move from mooring to other activities. Let's say that the scope of business is set by the Law and the requirements with the corresponding authority.

- Since the company was founded, what evolution have you seen in the maritime sector, and what is the key to staying for so many years?

As I said, the evolution goes through the entry into force of the Ports Law, to maintain and evolve means adapting to the regulations and investing in the physical means required. These means are getting older, and it is necessary to renew vessels, vehicles, installations... Maritime services are a somewhat peculiar business because the company buys the means in a context of already fixed prices and conditions. It may even happen that the rates drop the following year, with all that this implies.

Continuing with the evolution suffered by the sector, something that also affected negatively was the whole issue of industrial decarbonization, which meant that ships loaded with this raw material stopped coming, and instead, new cargoes did not come to replace it, so turnover was lost.

- From your point of view, what is the biggest challenge you have faced at BOTEROS, and do you foresee any other challenge in the short or medium term?

As the sector is so regulated, our challenge is to go from license to license, that is, soon there will be a new set of conditions that will determine the achievement of our new license for the next few years. They are usually more restrictive, so the biggest challenge is to get the new license according to the requirements of the new specifications.

- Would you say that the way of competing has changed nowadays, in what sense? In both the national and international markets, do you consider that there has been any significant change in the way of doing business, or obtaining contracts?

Before the Ports Law, the business was achieved by the companies on their own, looking for it and moving. Now everything has been very constrained, competition is based on the fact that another company can provide the same means that you have: the required ones. In the European sphere, the business is direct with the client, so if the client chooses you, it is allowed to establish specific and negotiated conditions. In contrast, here, the client who comes has to do so under very specific conditions already set.

At present, we do not see it feasible for Botaman to go abroad, since in that case the Group has other companies that are more appropriate for the international market.

- Are your company's competitors at regional, national or international level, what makes you different from the rest of your competitors?

There is no competition as such in our case since the competitor who comes has to contribute the same as us in terms of equipment, personnel and means, he will not bring more or anything different. Can there be competition? Yes, if the conditions for obtaining the license are met, but, what happens? The margins are so tight that they would not be viable for more licenses than those currently envisaged. In the case of Ferrol, for example, there are more companies in besides Boteros.

- Do you find difficulties for the development of your activity: infrastructures, transport, logistics, environmental regulations, etc. Could you tell us the advantages and disadvantages, strengths and weaknesses of the region?

In our sector, the region does not determine the existence of advantages or disadvantages. It is the same towing activity here as in Cadiz, for example. The big difference is given by the traffic volume of the port in question.

Yes, changes have been noticed over time, since 20 years ago environmental regulations have changed and have become more demanding, which is normal. The entire maritime field is very subject to very demanding laws against pollution, such as the MARPOL regulation, it started with oil tankers and then extended to other types of ships; something that, on the other hand, has allowed us the opportunity to provide services to fight against pollution that any ship coming to Ferrol may cause. We have all the necessary equipment, skimmers, barriers... let's say that it is not something negative for us because it broadens our business niche.

- We talk about innovation as one of the pillars for the development of companies. To what extent has R+D+i been important in Boteros' trajectory? And how far has it taken you?

Let's say that the mooring sector is not highly technological, unlike the towing sector. The innovations go through improving the boats and facilities, and everything related to workers' safety. They are mostly simple elements and developments that help or

facilitate the work, for example, now the ropes are not picked up by pulling as it was done in the past.

Especially in the area of boats, following the line of fight against pollution, the Group values the incorporation of hybrid or full electric engines, but at present they are not developed for the demanding power ramps necessary for our activity.

In the line of sustainability, for years our tugboats have thrown absolutely no water into the sea, they carry freshwater for their operation and there is no entry or exit of water; not even to refrigerate. In other words, they are polluting neither for the water nor for the atmosphere.

- From all economic sectors, Next Generation funds are expected to be an economic revulsive, how do you expect them to influence/repercussion for your case?

The truth is that I'm not sure, we have studied different possibilities regarding the provisioning of basic services (water and electricity) in a new mooring and towing base, for example; and also some studies for tugboats that work with gas, which are not fully developed today for our needs. But at the company level, I think it will be difficult for us to enter into these funds.

- For several years it has been believed that digitization and the implementation of new technologies will be key in the sector. Is a company like Boteros ready to tackle this digital transformation?

Being part of a large group that works globally is something fundamental, we have always been advanced in these aspects, with the latest generation equipment for communications, management of databases ... As for the digitization of the mooring activity is not something imperative as a necessity, it would not bring us too much at present.

- Have you had to change your strategy or plans for the future as a consequence of the economic situation caused by the Pandemic, and now aggravated by the situation in Ukraine?. How is this crisis affecting you?

Yes, we must bear in mind that we do not have a regular commercial director, our customers are those who come, that is, they have to export or import through the port, or decide to bring their ship to repair. We are constrained to what comes. The Pandemic was a hard blow, there was a gap of 3 or 4 months in which it affected quite a lot because the traffic forecasts were paralyzed. Although we saved the situation, it could have been worse.

Regarding the war...maybe it is too soon, as of today I would not be able to make a forecast of what is going to happen. But clearly, it is going to affect us, for now with the rise in fuel prices. In other ports it is already being seen, bulk carriers do not come here, but in other ports of Galicia they do, and it may have repercussions in that fewer ships will come. To give a figure, Galicia imports some 300,000 tons of grain.

- At a time like the present, what measures do you consider urgent/necessary from Botaman to strengthen and protect the sector?

Although I am from Ferrol, I am not very optimistic about the shipbuilding sector. As for new constructions, it seems that the city is doomed to make warships when the State opens financing lines. Moreover, in order to be viable in the repair business, I believe that we need to improve the service and make it much more attractive. To attract new customers that are not the traditional ones, or those that have no choice but to come for logistical or economic reasons, it would be necessary to increase yields, modernize... apply a new philosophy that affects price competitiveness and quality.

- Another challenge we are facing is the renewal of the workforce. Why is the youngest not attracted to the sector? How can companies seduce young talent? Do you have this problem/difficulty? Why do you think it is?

It is a generic problem in all sectors of the maritime field. Galicia and the north of Spain have been very relevant in the education and generation of seafarers. In recent times less, it is noticeable in the schools, where there are few people. There are se-

veral factors, one of them is that many companies have not treated their staff properly; on the other hand, fishing is no longer the great attraction it once was, which has been discouraging the new generations. Something to keep in mind is that the higher the standard of living in a country and the better one lives, the fewer people are available to go to sea. We are in a difficult time to find maritime personnel. For example, in our house we already have foreign personnel, there comes a time when you need qualified staff, with experience, and it is very difficult to find them. Years ago, trained personnel came to the mooring, with the trade already learned, nowadays you have to train your own personnel. It is something generic to the maritime field, conditions will have to improve.

- The protection of the environment is one of the challenges that the industry faces, do you think that they are taking measures in this regard, do they affect you negatively?, what could be improved?

We are very regulated, we have periodic inspections by the administration. If, for example, the oil is changed in a boat, it must be done and delivered according to the guidelines and protocols of the Captaincy. Everything is highly regulated and controlled; we have to comply with the conditions established by the Law. Besides, I do not think that any shipowner is worried about it, it is something necessary and we all depend on respecting and taking care of the environment in which we develop our activity. It is something that will have a positive impact on the whole.

- Given the challenges ahead, are you optimistic about the future?

I am an optimist by nature, and from a business point of view, one thing is clear: we depend on the overall functioning of the economy, if it goes well, everything will work. In our case, it goes well for us if ships come, that is, if someone decides to repair, import or export, through our sphere of influence. It does not depend so much on us as on the functioning of the economy in general and of our region in particular.

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