Novel technologies to boost the shipyard industry

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USER-CENTRIC SOLUTIONS FOR A FLEXIBLE AND MODULAR MANUFACTURING IN SMALL AND MEDIUM-SIZED SHIPYARDS

Félix Vidal (AIMEN Technology Centre)

ORGANIZED BY THE EU HORIZON 2020 PROJECTS:

FIBRE4YARDS SHIPYARD FOR THE FUTURE

RESURGAM

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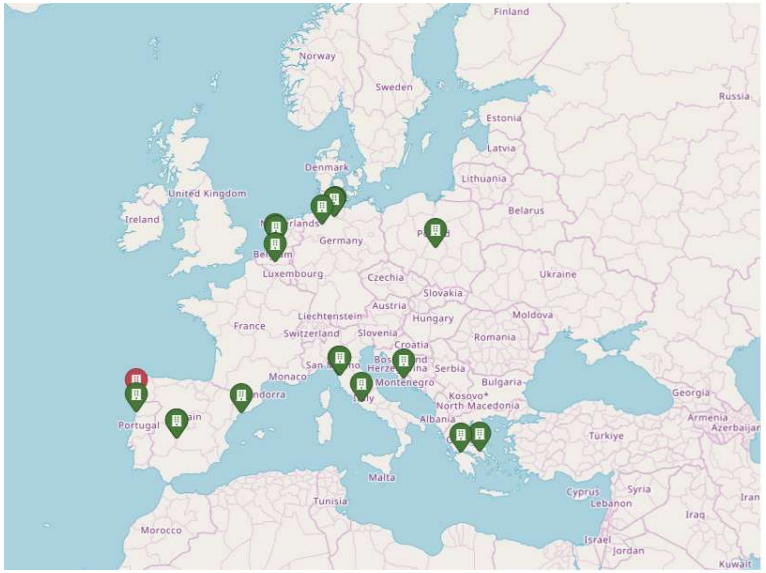
30th and 31st May 2023, RTD Innovation Dock, Rotterdam

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements n° 101006860 (FIBRE4YARDS), n° 101007005 (RESURGAM), and n° 101006798 (Mari4_YARD).

Consortium

- 18 partners
- 9 countries

H2020-MG-3-7-2020: Improved Production and Maintenance Processes in Shipyards



Project Information

Mari4_YARD

Grant agreement ID: 101006798

DOI

10.3030/101006798

Start date	End date
1 December 2020	30 November 2024

Funded under

SOCIETAL CHALLENGES - Smart, Green And Integrated Transport

Total cost

€ 5 913 440

EU contribution

€ 4 998 824,76

Coordinated by

ASOCIACION DE INVESTIGACION METALURGICA DEL NOROESTE

Spain

https://www.mari4yard.eu/

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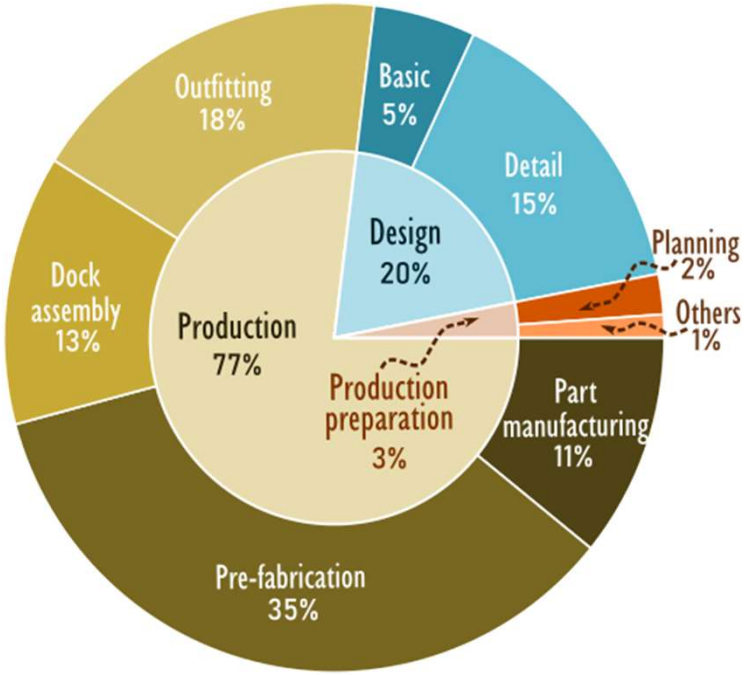
Needs targeted

- An **increasing complexity in design and manufacturing** setup
- Limited **production efficiency and product quality**:
  - Low-volume/one-of-a-kind production schemes
  - Tolerances, deformations impose recurrent reworks and reconfigurations
- Preservation of the **industry-specific knowledge and skills**: Factory workers are key resources for sectorial competitiveness
- **Supply Chain integration** (both external and internal)
- Struggle to **remain competitive and attractive**



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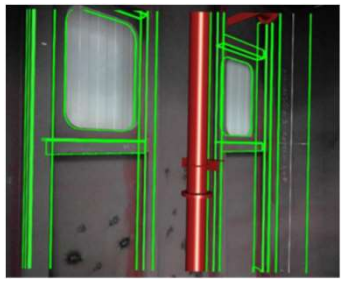
In a nutshell

Portfolio of portable, flexible and cost-effective worker-centric solutions



To be deployed in different stages of the shipbuilding: **steelwork production, pre-fabrication, outfitting**

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In a nutshell

Scenarios

- Shipbuilding
- Retrofitting/Repairing

Impact areas

- Safety
- Quality
- Productivity

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Objective and concept

Worker-centric approach

Scope

- Increase the efficiency in the manufacturing of complex vessels by small and medium-sized shipyards
- Preserving industry-specific workers' knowledge

Approach

- Automation based on worker-centric tools
- Modular, portable and flexible equipment

Deployment

- New construction and retrofitting/repairing
- Steelwork, pre-production and outfitting stages

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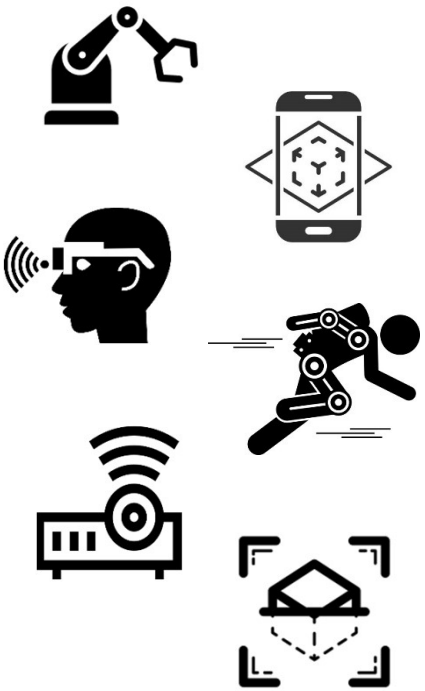
Technical Objectives

To implement a portfolio of worker-centric tools (TRL 7)



- High-payload collaborative robots for assisting operators and acting as work-holding devices
- Flexible and mobile manipulators (Easy to deploy)
- Upper-limb and lumbar exoskeletons
- Projectors and handheld devices providing instructions to operators in the manufacturing processes
- Head Mounted Displays for training.
- Digitalization and reverse engineering (3D scanning)

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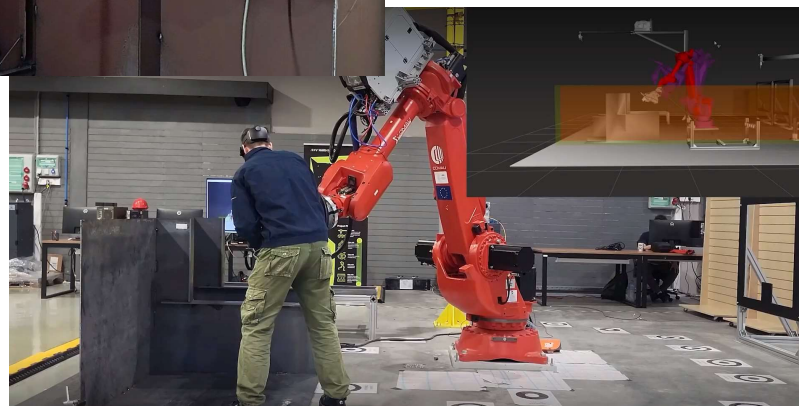
Technical objectives

Development of intuitive human-robot collaborative solutions



- Symbiotically integration of operators' skills and dexterity into flexible and reconfigurable solutions ↑
- Safe, modular and collaborative robot solutions ↑
- Programming and setting time reduction by skill-based and intuitive robot programming ↓
- Reduction of production process time ↓

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Technical objectives

Development of intuitive human-robot collaborative solutions

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WELDING JOINT DETECTION

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CANONICAL ROBOTS

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ROBOT LOCALIZATION AND PLASMA CUT

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CANONICAL ROBOTS

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Technical objectives

To develop handheld and portable AR/MR tools for assisting shipyard workers

- Reducing reworks and changes, particularly in the latest phases of the construction.
- Increasing precision and quality by relying on AR/MR tools for a precise positioning of the different subassemblies
- More efficiently training for new shipyard workforce in machinery and deck equipment.

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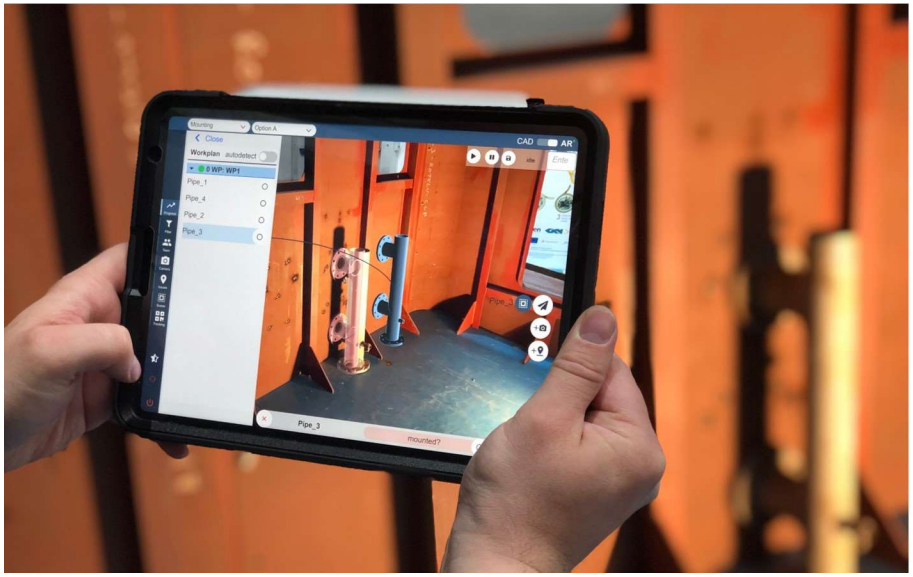
Technical objectives

To develop handheld and portable AR/MR tools for assisting shipyard workers



Technical objectives

AI-assisted exoskeletons for reducing fatigue and physical stress

- Reduction of workers physical effort in the execution of the target tasks
- Usability and acceptability assessed
- Improvement of the ergonomics risk factor in the target applications

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Technical objectives

AI-assisted exoskeletons for reducing fatigue and physical stress

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Technology transfer and impact

Demonstrate Mari4_YARD approach at real-scale targeting both shipbuilding and retrofitting in SME-shipyards (TRL7), fostering results exploitation and enabling EU wide manufacturing adoption

- **2 real-scale demonstrators** (TRL 7) in small-sized (NODOSA) and medium-sized (BRODOSPLIT).
- **Didactic Factories Network**: 5 open pilot lines, hosted at RTOs, enabling EU-wide workforce upskilling and technology adoption by EU industry, ensuring a successful market uptake
- **Mari4 alliance community**: engage stakeholders to participate in the community, promoting the Mari4_YARD and its results and opportunities.
- **Training courses**

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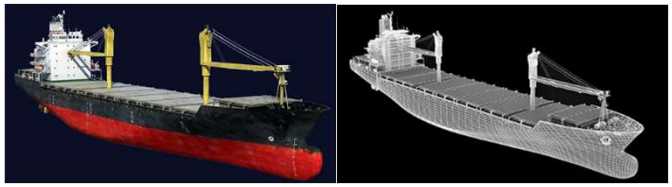
Worker-centric tools to be deployed

Brodosplit shipyard deployment and impact

- Exoskeletons for manufacturing activities
  - Ergonomic improvement
- Digitalisation using reverse engineering, 3D scanning and 3D modelling
  - Production planning
  - Continuous monitoring
  - Pre-step for other digitalisation phases
- Augmented reality
  - Construction supervision
  - Production planning
  - Workers training
- Use of robots with fast programming
  - Production improvement
  - Quality improvement



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Worker-centric tools to be deployed

Nodosa shipyard deployment and impact

- Use-centric tools of main interest
  - Exoskeletons for welding in non-ergonomic poses
  - Use of small robots inside the vessels for welding operations
  - Use of robots in shared space in the workshop (fast teaching)
- Situation for other technologies
  - Digitalisation using reverse engineering, 3D scanning
  - Augmented reality

- Potential impact
  - Improvement on working conditions
  - Reduction of welding time
  - Improvement on repeatability and quality of welding

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Didactic Factories Network

Open and real-scale demonstrators for workforce training at the EU level to accelerate the adoption of novel methodologies in shipbuilding.

Scope

Network of centres and general-purpose showroom facilities that will remain open to allow for training and skilling-up for given technologies.

Main Objectives

- Provide upskilling and re-skilling of shipyards workforce
- Demonstration of technologies that could be used to advance shipyard processes
- Provide infrastructure for third parties to test new technologies and solutions (technology developers and system integrators)

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Mari4 alliance community

- Workshops & Trainings
  - 1st Workshop.
  - 2nd Workshop
  - 3rd Workshop soon!

Mari4_YARD First Workshop

Mari4_YARD 2nd Workshop

- Replicability and cross-industry technology scouting
  - Benchmarking between the developed technologies and already existing ones, taking advantage of the Didactic Factories Network.
  - Formulating more robust recommendations to SME-shipyards
  - Openly accessible ***Best Practice Handbook***

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THANKS
FOR YOUR ATTENTION

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