FIBRE4YARDS
SHIPYARD FOR THE FUTURE

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TSI

WP3: « Design and Engineering for Vessel Production Improvement »

WP4: « Smart manufacturing approach for developing shipyard 4.0 strategy »

First Information Day – 01/07/2021

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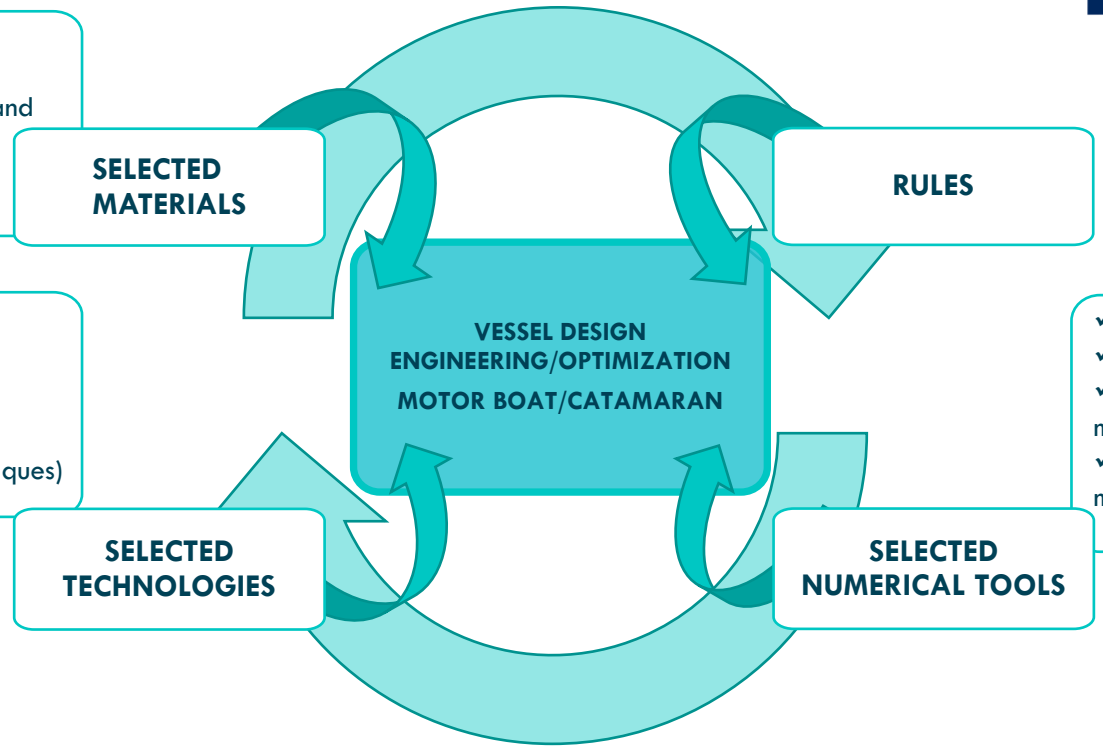
WP3 objectives and tasks

- Develop specific numerical models in order to simulate composites with the developed technologies:
  - Constitutive model for **thermoplastics**.
  - Beam model for **pultruded profiles**.
  - Numerical model for **3D printed composites**.
  - Numerical multi-model for **composite connections**.
- Implement such numerical models in already existing CAE/FEM tools (TdynRamSeries), so that they can be incorporated among the vessels' design and engineering tools.
- Engineer and develop two modular vessel designs: **patrol motorboat** and **passenger catamaran**.
- Re-design and optimize both vessel designs, in order to adapt their manufacturing to the advanced production methods presented in the project.
- Enable both designs for Industry/Shipyard4.0 standards.
- Thoroughly study and account for the mechanical performance of the connections between the different vessels' modules.
- Gather adapted guidelines for the re-design and the production with advanced technologies, so that they comply with standard and Rules.

WP3 Implementation plan

- ✓ WP materials mapping and selection



- ✓ 3D printing
- ✓ Curved molds
- ✓ Pultrusion composite beams
- ✓ Advanced connection techniques)

- ✓Thermoplastics constitutive model
- ✓Pultrusion Beam model
- ✓3D Printed composites numerical model
- ✓Composite connections numerical multi-model

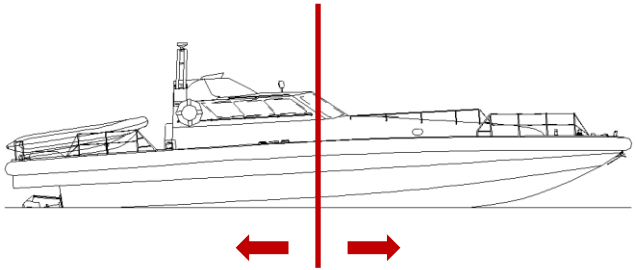
WP3 Implementation plan: Design/Engineering/Optimization

MOTOR BOAT

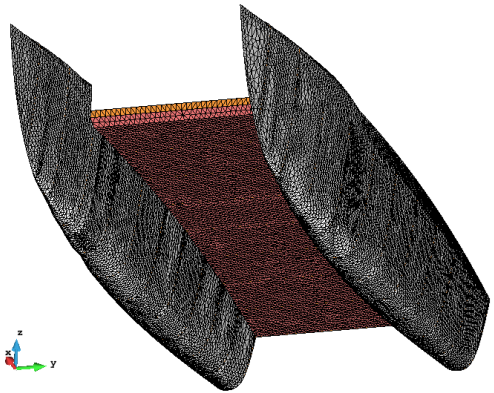
- Two 3D printed halves.
- Modules connection techniques.
- Internal structure layout redefinition.
- Verification of resultant design: Naval architecture and structure FEA.
- Verify compliance with rules.

CATAMARAN (TSI)

- Superstructure with curved panels.
- Use of pultruded reinforcements.
- Connection techniques.
- Verification of resultant design: Naval architecture and structure FEA
- Verify compliance with rules.

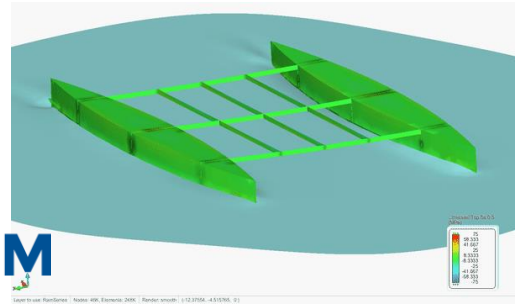


- Modular production optimization
- Assembly/connection of modules optimization
- Attachment of reinforcements optimization
- Production/assembly compliance with rules verification
- Optimize production of curved panels
- Optimize production with pultruded reinforcements
- Optimize assembly/connection of S/E with hull
- Optimize S/E aerodynamics

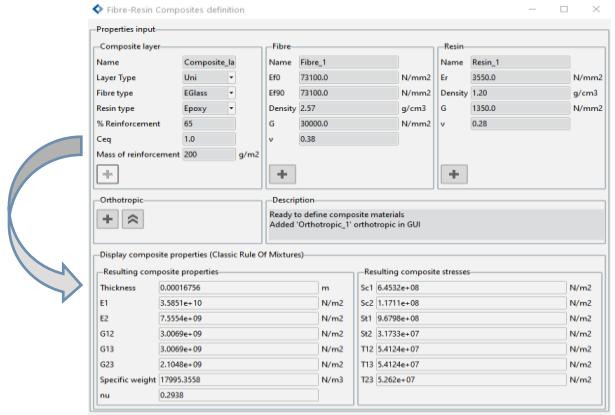


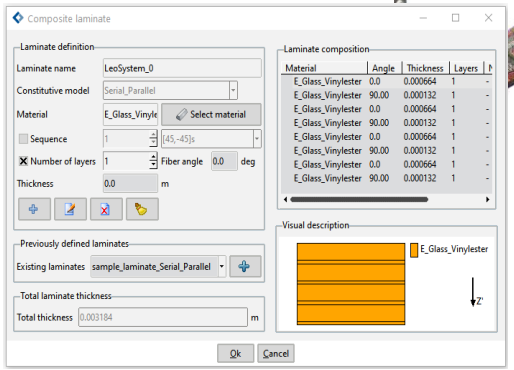
WP3 Implementation plan: CAE/FEA Tools for Design/Engineering/Optimization

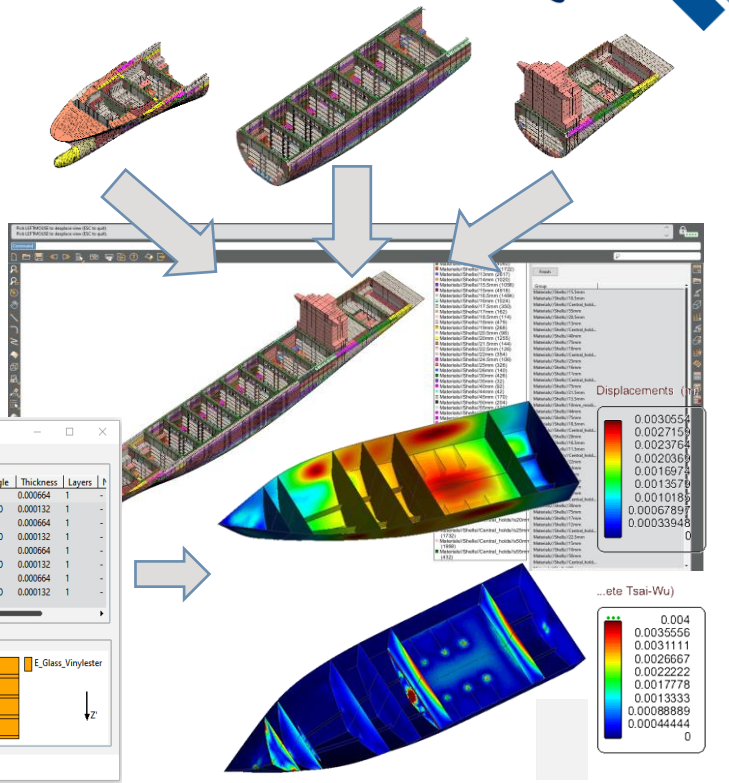
SeaFEM



RamSeries







WP3 Expected Impacts within the FIBRE4YARDS impact axis

1. **Impact axis 1 – Competitiveness and Growth for Small and Medium shipyards.**

   - Advanced engineering and production automation integration for FRP composites will:

     - ✓ **Shorten production lead times by 50%:** Automation (VS manual and artisanal labor) will improve production speed and quality consistency.
     - ✓ **Save 20-30% weight in produced structures:** High strength VS weight ratio of the materials. Integrated parts. Reduction of joints and fasteners.
     - ✓ **Lower corrosion issues:** Lower maintenance costs.

2. **Impact axis 2 – Employment and Skills of European Workforce.**

   - Existing FRP labor, IT, design and engineering work force will **shift towards higher skilled tasks** through specific training, while new posts will also be created.

3. **Impact axis 3 – Improved Environmental Performance.**

   - As a result of re-engineered designs for optimized and low energy-consuming FRP manufacturing processes.

4. **Impact axis 6 – Regulations and Standards.**

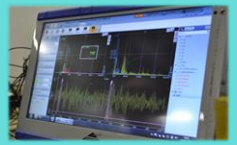
   - New designs, and new specific numerical methodologies and tools for structural verification will require standards to be adapted.

WP4 objectives and tasks

FIBRE4YARDS aims to define an **strategy** for the **development of a new generation of shipyards enabled with industry 4.0 technologies**. WP4 main tasks for such purposes are:

- Definition of a **monitoring system** based on IoT technologies for the control of the different production processes involved in the project, both in terms of factory maintenance and quality control.
- Development a physics-based and data-based **Digital Twin Model** (DTM) of the different production assets of the shipyard that can be fed by the data collected by the monitoring system, allowing for real-time control and maintenance of the different assets.
- Definition of the **cybersecurity** protocols and strategies to follow in order to guarantee data privacy and secure data flow through the network.
- **Definition** of IoT based smart applications and technologies that can be directly applied to shipbuilding in order to achieve the **shipyard 4.0** concept and consequently improve production and maintenance processes.

WP4 Implementation plan



Predictive maintenance

Connectivity

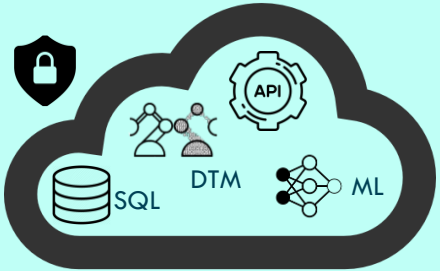
Accessibility

Quality & production control

KPIs driven decisions

SHIPYARD 4.0

- DTM of every relevant asset.
- ML algorithms for predictive maintenance.



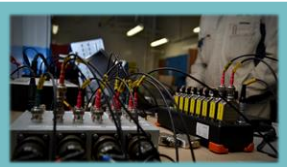
- Cybersecurity and data privacy.
- APIs to interact with the platform.

SOFTWARE LAYER

Asset analysis and KPI definition

Sensor selection and installation

Data ACQ and communication cabinets



HARDWARE LAYER

WP4 Expected Impacts within the FIBRE4YARDS impact axis

1. **Impact axis 1 – Competitiveness and Growth for Small and Medium shipyards.**

   ✓ Shipyard 4.0 will favor production facility sharing and both improved efficiency and safety at work.

2. **Impact axis 2 – Employment and Skills of European Workforce.**

   ✓ Favoring a shift towards higher skilled jobs while maintaining a net positive job count.

3. **Impact axis 3 – Improved Environmental Performance.**

   ✓ Through the optimization of energy-consuming manufacturing processes as well as minimizing rejected parts.

4. **Impact axis 5 – Maximize EU added value by minimizing technology leakage.**

   ✓ Addressing cybersecurity as a highly relevant aspect throughout the whole work package.

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Thank you !

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