



Deliverable n°4.4.1

Implementation report of the sailboat

April 2022

PP LEADERS: KAIROS



European Regional Development Fund



Partners

KAIROS, TEILLAGE VANDECANDELAERE

Tasks done

1) Objectives :

The objective of this report is to present the stages in the construction of the Birdy Fish foil sailboat, the problems encountered and the means used to solve them. It presents the different operating procedures followed and the subcontractors involved in the construction of this prototype. The advantages and disadvantages of the solution developed are detailed.

This technical report is based on the previous deliverables of the work package *MT T3 - Sewn and woven semi-finished products, exclusively made of fibres* and the deliverables of the module MTT4 (T4.3.1 and T4.3.2).

2) Partners and sub-contractors

Several entities were involved in the realisation of the Birdy Fish sailboat in linen. Among the FLOWER partners, Teillage Vandecandelaere provided the semi-finished products for the realisation of the sailboat. They provided the biaxial fabrics developed in the MTT3 work module and also balanced and unidirectional semi-finished products used in the various areas of the sailboat (c.f. Deliverable T4.3.2 sailboat manufacturing plan).

Several subcontractors were also involved in the construction of the sailboat.

Kairos rented the hull, deck and bulkhead moulds from Birdy Fish. Birdy Fish also provided human resources to assist Kairos in the construction of the hull, deck and structural bulkheads in biocomposite. The assembly of the fittings and standard equipment was also carried out by Birdy Fish.

AMICO is the manufacturer of the composite parts of the Birdy Fish sailboat. AMICO made its premises available to the project and welcomed Kairos to build the Birdy Fish sailboat in linen.

The company Atelier de la fibre supported the company Kairos for the implementation of biocomposite parts

3) Manufacturing process and materials

One of the objectives of FLOWER is to facilitate the dissemination of the semi-finished products developed in the framework of the project. Thus Kairos has selected the infusion process for the implementation of the sailboat. This process is conventionally used in shipbuilding. It consists, firstly, of depositing the textile semi-finished products and the core materials in the mould of the part to be produced, and then of making the resin migrate through the semi-finished products thanks to the



pressure difference generated by a vacuum pump. This process is commonly used in the processing of large parts made in small quantities. It is well suited to the processing of composite parts in shipbuilding. This process is also well suited to the processing of flax fibre composites.

The knowledge developed during the infusion parameter tests, presented in deliverable T4.1.1, allowed the optimisation of the sailboat implementation process. The main evolutions of the infusion parameters brought by these tests are the following:

- Vacuum level: favour the highest possible vacuum level, close to atmospheric pressure
- Resin condition: favour fluid resins (< 170 mPa.s) and control the temperature during processing (between 20 and 25°C).
- Dry the fibres before processing in a chamber at 20°C and 40% humidity for at least 4 hours before draping.
- Leave the fibres under vacuum for at least 12 hours before infusing the resin.

4) Realisation steps

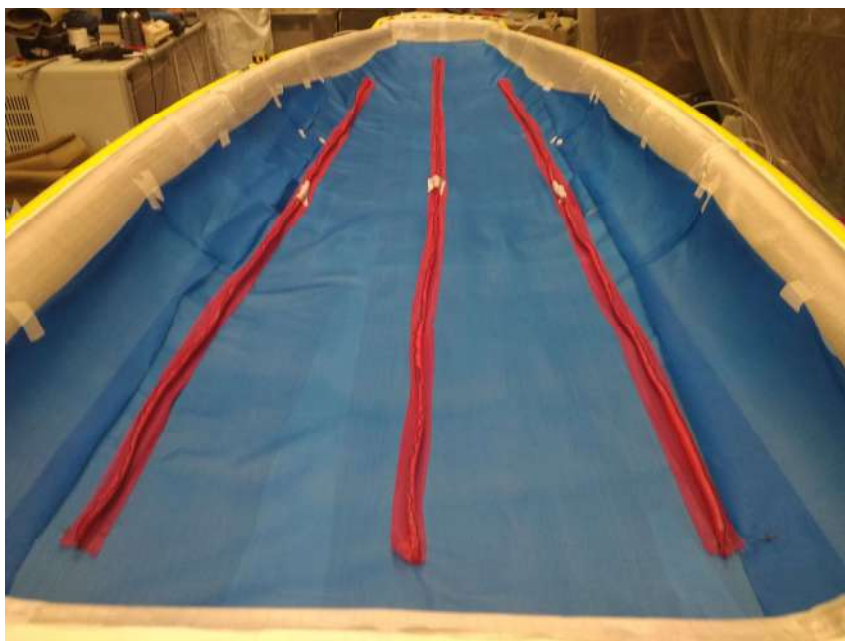
a) Hull manufacturing



Gel Coat and outer skin draping



Draping of cork core material



Draping of the inner skin and infusion peripherals



Placement of the vacuum tank and injection bars



Infusion of the hull



Demoulding of the hull



b) Deck manufacturing



Draping of the deck



Infusion of the deck



c) Manufacturing and assembly of the internal structure



Internal structure

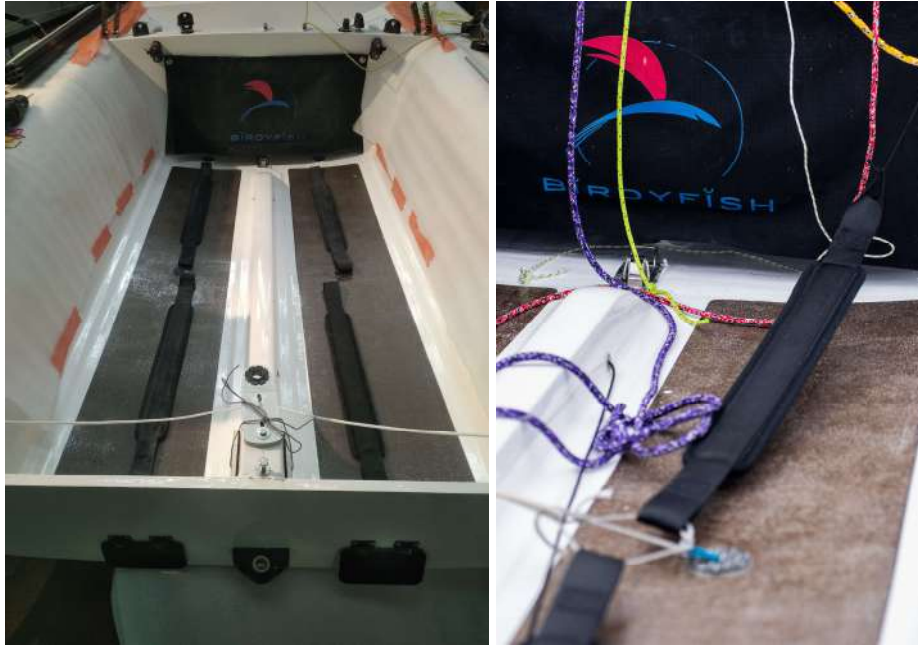
d) Assembly and finishing



Assembly hull/deck



Assembly of the fittings



Varnishing of the exposed flax cockpit

5) Navigation trials



On th beach ready to go



First flight of the flax Birdy Fish

6) Next steps

From June 2022 the boat will be used by the Glénans sailing school. Trainees learning to sail will be able to use this boat and become aware that flax fibres and boats made of biocomposites can be as efficient as boats made of glass fibres. This use in a sailing school will allow to follow the evolution of the ageing of the boat following an intensive use.

Conclusion

This report presents a synthesis of the work that was carried out for the construction of the sailing boat Birdy Fish in flax. It is based on the results obtained during the work carried out on the MTT3 and MTT4 modules. The multiaxials developed in the MTT3 work module have shown that they are technically suitable for shipbuilding and that they can be used to build a high-performance sailboat demonstrator. These multiaxials can now be proposed for industrial use. Minor optimisations, in particular on the possibility of obtaining the multiaxials in small widths, are underway with Teillage Vandecandelaère to facilitate their use in certain circumstances.