



***Case Study***

# ***A Cork Application in Drones***

**ecoCORK**



Co-funded by the  
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## A CASE STUDY: CORK BASED DRONE APPLICATION

### 1. Introduction

Unmanned Air Vehicles (UAVs) are extensively used in almost every sector. Drones are one of the UAVs that are highly popular for search, rescue and surveillance operations [1]. In some operations, drones have to be operated in closed environments such as underground, caves or inside buildings. At these conditions, especially in confined spaces or narrow channels, body or propeller of the drones hits at the walls and thereby having severe damages. In order to protect the drones in confined spaces, various types of covers with the drones are used.

There are several reasons regarding the selection of cork in drone cage applications. Some reasons why cork based materials are preferred in drone applications are summarized below.

- **Lightweight and High Strength:** Drones need to be lightweight to achieve efficient flight and extend their operational range. At the same time, they need to be structurally strong to withstand the stresses and strains experienced during flight and potential crashes. Since cork possesses a favorable combination of lightweight and high strength properties, it is considered for drone constructions [2].
- **Vibration Damping:** Drones can generate vibrations that may affect the stability of the platform and the quality of captured footage (in the case of camera drones). Cork is known for its vibration-damping characteristics, which could potentially help reduce the impact of vibrations on the drone's components [3].
- **Acoustic Insulation:** Some drones, particularly those used in certain research or surveillance applications, may require low acoustic signatures to avoid detection. Cork's acoustic insulation properties make it useful in reducing noise emissions [4].
- **Thermal Insulation:** In certain drone applications where temperature control is critical, such as in environments with extreme heat or cold, materials with good thermal insulation properties help protect sensitive components from damage. Cork offers advantages in this regard [4].
- **Sustainability:** If drones are intended for environmentally sensitive applications, such as wildlife monitoring or environmental surveys, the use of sustainable materials like cork could be appealing due to its renewable nature and low environmental impact [5].

In ECOCORK, an original cage is designed for a drone to protect it from crashes in confined spaces as well as benefitting from the aforementioned advantages of cork.

### 2. Design and Manufacture of Drone Cage

In the design of drone cage, an effort was paid by conducting the literature survey. This step provides the starting point of design. Based on the current technology in the field, a basic structure was designed at the first trials. A sample design for drone cage is given in Fig. 1.



Fig. 1. A sample design for drone cage

Upon deciding on the dimensions and concept design, mechanical analyses were carried out to understand about the limits of the design. In the mechanical tests, some parts and joints were found as critically weak in terms of strength. In order to reinforce the structure, these regions were then supported by small design changes as well as using carbon fiber facesheets in the cork based sandwich structures. The components were cut by using a laser machine and then sandwich structures were prepared by stacking the top/bottom layers and cork based core material. An epoxy resin (L285) and hardener (LH285) based adhesive solution was used for joining the components. The final structure was weighted 504 g, which proves a lightweight structure for the drone application. Fig. 2 shows the manufacturing steps for the drone cage.

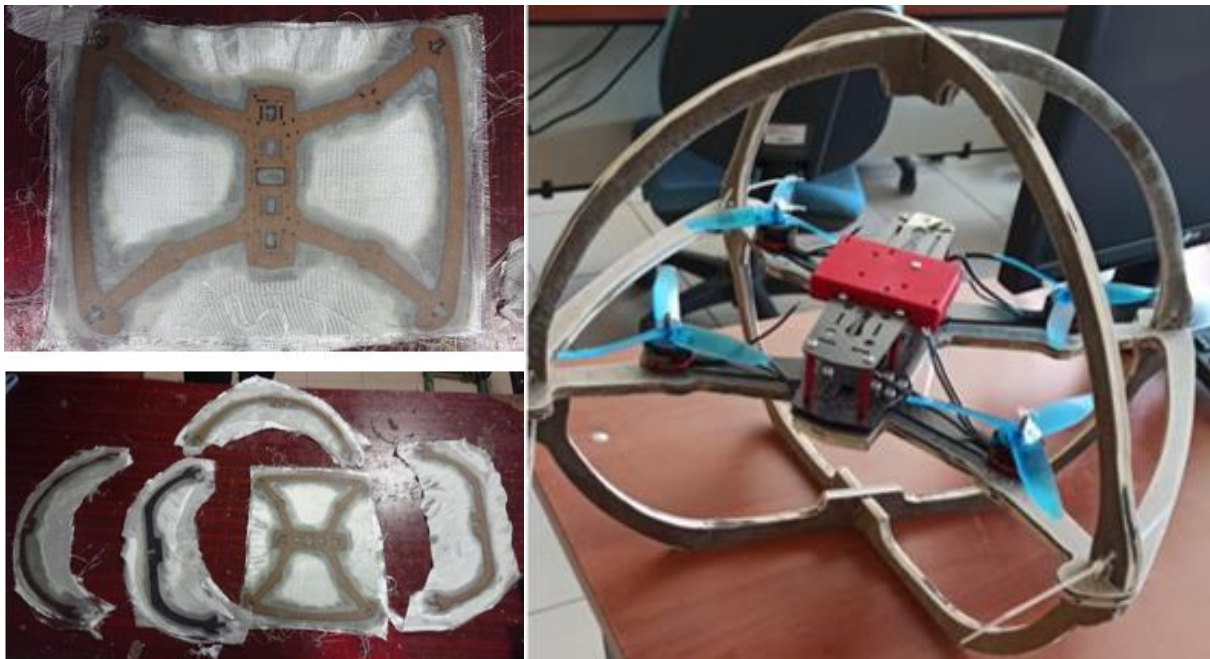


Fig. 2. Manufacturing steps for the drone cage



The first prototype was tested in terms of mechanical loadings. Based on the results, the structure provided an opportunity to reduce the weight in the structure. To do so, number of carbon fiber layers was reduced, which also led to a reduction in the impregnated epoxy matrix in the product. Then, the revised design was also investigated in the mechanical testing. According to the results in the final stage, the cage design satisfied the mechanical requirements while providing a lighter structure for the drone. In the final form, the weight of the drone cage was weighted as 374 g, which is highly efficient for drone applications. Fig. 3 shows the final design of cage components for the drone application.



Fig. 3. Final design of cage components for the drone application

### 3. Conclusions

This case study is carried out to demonstrate the cork applications in air vehicles. For this purpose, a drone platform with a cage is designed and manufactured by using cork based composites. After producing the drone platform, an electromotor is installed to the cork based platform to make it fly. This case study shows the applied aspects of ECOCORK in addition to the theoretical sides regarding cork in aerospace applications.

### References

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