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Fabrication of Drone Components by Using Composite Glass Fibre

Mr. P. R. Shelake[1], Mr. T. M. Ambad[1], Mr. B. B. Kumbhar[1], Ms. B. M. Deshmukh[1], Prof. A. A. Jadhav[2]
[1]Student, Department of Mechanical Engineering, SVERI'S College of Engineering Pandharpur, Maharashtra, India
[2]Assistant Professor, Department of Mechanical Engineering, SVERI's College of Engineering, Pandharpur, Maharashtra, India

ABSTRACT
This study explores the fabrication of drone components utilizing glass fiber and epoxy composite materials. The use of these materials offers a lightweight and durable solution for constructing various parts of drones, including frames, wings, and other structural elements. The fabrication process involves techniques such as laying down glass fiber sheets and impregnating them with epoxy resin to form strong and rigid composite structures. This paper presents a comprehensive overview of the fabrication process for constructing unmanned aerial vehicles (UAVs or drones) utilizing composite glass fiber as the primary structural material. Composite materials, renowned for their high strength-to-weight ratio and durability. The fabrication process encompasses several key steps, including design and planning, material selection, mold preparation, composite layup, vacuum bagging or compression molding, curing, The integration ofthese materials in drone manufacturing aims to enhance performance, durability, and flight characteristics while maintaining a lightweight design. This abstract provides an overview of the fabrication methods and the potential benefits of utilizing glass fiber and epoxy composites in drone component production.

Keywords- Drone, UAV, Glass fibre, composite body, Epoxy resin, fibre, fabrication

I. INTRODUCTION

The focus on using glass fibre composite sheets for manufacturing of drone components through vacuum bagging techniques and assembly of drones. Glass fiber composites are known for their high strength and lightweight properties, are crafted by combining glass fibers with a polymer matrix(epoxy resin).Vacuum bagging, a method integral to composite manufacturing, involves the use of vacuum pressure to consolidate materials, reducing voids and enhancing overall strength. The primary objectives encompass optimizing the fabrication process of these composite sheets. This involves fine-tuning the layering techniques and material compositions to ensure superior structural integrity and performance. Subsequently, the manufactured composite sheets serve as the foundation for producing various drone components, including frames, drone arms, shock absorber plate, base plate, propellers. These components are engineered with precision to maintain consistency and reliability in their construction. The final objective involves the assembly of these components

into fully functional drones. Continuous testing and evaluation of the drones 'performance, considering flight capabilities, stability, and endurance, form a crucial phase. This iterative process aims to identify areas for enhancement and refinement in both material fabrication and drone assembly, ensuring that the end products meet specific requirements or industry standards. Overall, it integrates advanced composite materials into drone manufacturing, emphasizing continuous improvement through testing and optimization.

II. EXPERIMENTATION

A. Selection of Material

For this research of manufacturing of composite drone body we selected glass fibre 200 GSM as composite material. This material was selected due to following mechanical properties High Strength, Stiffness, Lightweight, Corrosion Resistance, and Electrical Insulation.

B. Development of Glass Fiber Composite-Based Drones.

1. The Glass Fibre : Choose the appropriate weight and weave for the specific part you're manufacturing.
2. Epoxy Resin: Select a high-quality epoxy resin suitable for composite applications.
3. Mould or Form: Depending on the part, you might need a mould or form to shape the composite material.
4. Release Agent: To prevent the composite from sticking to the mould.
5. Mixing Tools: Stirrers, mixing containers for epoxy resin.
6. Vacuum Bagging System : For more advanced manufacturing, a vacuum bagging system can be used to remove air bubbles and enhance the consolidation of layers.

III.DESIGN OF COMPOSITE DRONE PARTS

The design of components were carried out in AUTO CAD software. The following parts were designed 1.Centre Plate, 2. Upper Plate, 3. Shock Absorber (Lower Plate)

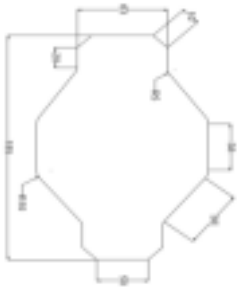

Fig.1.Centre Plate

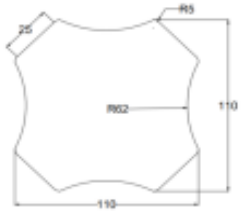

Fig.2.Upper Plate

Fig.3.Shock absorber (Lower plate)

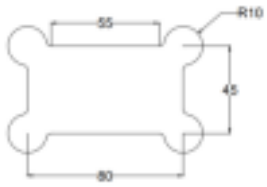

Fig.4.Shock absorber (Upper plate)

Fig 5. Drone Arm

A. Steps involved in manufacturing of drone components.

1. Design and Planning: Define the specifications and requirements of the drone components. Dimensions of arms and all other components. Determine the optimal fiber orientation and layup configuration for maximizing strength and stiffness.
2. Material Preparation
   - High-quality glass fiber of 200 GSM reinforcements, typically in the form of woven fabric.
3. Laminate Manufacturing: Composite Lay-Up
   - For Manufacturing of laminates we prepared mould and arranged other materials like peel ply, breather material and Mould releasing agent or wax. We Cut the glass fibre cloth or mat according to the design of the part. After this the resin and hardner were mixed in the volume proportion of 3:1. Apply layers of resin onto the mold surface, either manually or using automated equipment. Lay the glass fiber material onto the resin-coated mould, stack them according to the designed layup sequence. We ensured thorough impregnation of the fibers with resin, removing any air bubbles or voids to promote bonding and consolidation.
4. Vacuum Bagging.
   - · Vacuum was given to the mould by using vacuum pump to remove all the bubbles and gaps from the mould .

Fig 7.Vacuum Bagging

5. Curing:
   - The mould was allowed to cure for 12 hours.

B. Manufactured Drone components.

Fig 7.Centre Plate

Fig 8.Centre Plate

Fig 9.Shock Absorber Plate(Lower Plate)

Fig 10.Shock Absorber Plate (Upper Plate)

Fig 11. Drone Arm

IV. ASSEMBLY OF DRONE COMPONENTS

- The Parts as like upper plate, Centre Plate, lower plate and shock absorber plate were assembled with each other by screw mechanism. For mounting of motors small drills are provided on the arms at the end of arms. Four drills of 3mm in size were drilled for allocation of motors.
- To reduce weight and to achieve aerodynamic structure arms were designed for proper functioning.

Fig 12. Drone arm for weight optimization.

V. ASSEMBLY OF DRONE

Fig 13. Fully assembeled drone.

TABLE : WEIGHT COMPARISON FOR CONVENTIONAL AND GLASS FIBRE DRONE

Sr. No.	parts	Conventional PVC drone Fiber	Glass Fiber
1	Arm	50 gm	33 gm
2	Centre Plate	40 gm	25 gm
3	Upper Plate	20 gm	17 gm
4	Upper Shock Absorber	12 gm	5 gm
5	Lower Shock Absorber	8 gm	7 gm

VI. CONCLUSION

The fabrication of drone components and the pursuit of weight reduction are essential endeavors in the evolution of drone technology. Through innovative fabrication techniques such as additive manufacturing and advanced materials selection, components can be optimized for strength, durability, and weight efficiency. This not only enhances drone performance but also extends flight times and payload capacities.

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