BHAGALPUR COLLEGE OF ENGINEERING

(Dept. of Science & Technology, Govt. of Bihar) [Approved by AICTE & Affiliated to AKU]

A MINI PROJECT REPORT ON

"RC AIRCRAFT MODELLING"

submitted By

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Under the guidance of:

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Project Overview

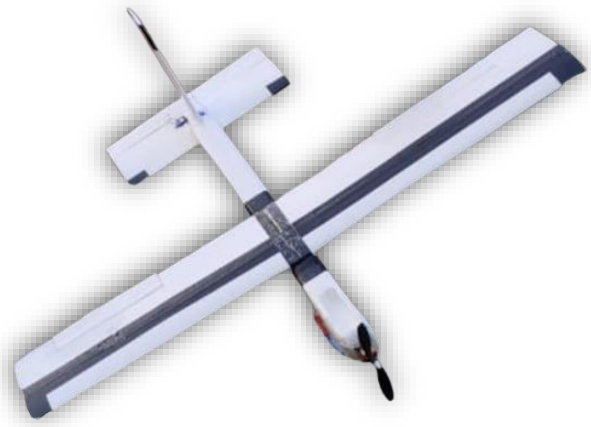
This project involved fabricating and optimizing a simplified model of a high-rectangular-winged aircraft with 2 degrees of freedom (2-DOF). The primary objective was to enhance its gliding performance through Computational Fluid Dynamics (CFD) simulations by analyzing the effect of Angle of Attack (AOA) on lift and drag.

Fabrication

- **Model Type:** High-rectangular-winged aircraft
- **Degrees of Freedom:** 2-DOF
- **Materials Used:** Foam board, adhesive, lightweight covering material

Construction Process:

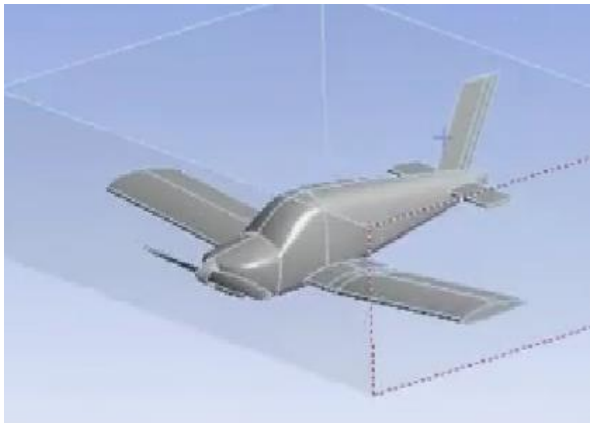
1. **Wing Construction:** Cut the foam board into the Aerofoil wing shape and size. Reinforce with balsa wood spars for added strength.
2. **Fuselage Construction:** Construct the fuselage using balsa wood, ensuring it is lightweight yet sturdy.
3. **Assembly:** Attach the wings to the fuselage securely. Ensure the alignment is correct to maintain aerodynamic stability.
4. **Covering:** Apply a lightweight covering material to the wings and fuselage to reduce drag and improve aerodynamics.
5. **Final Touches:** Add control surfaces and any necessary electronics for testing.

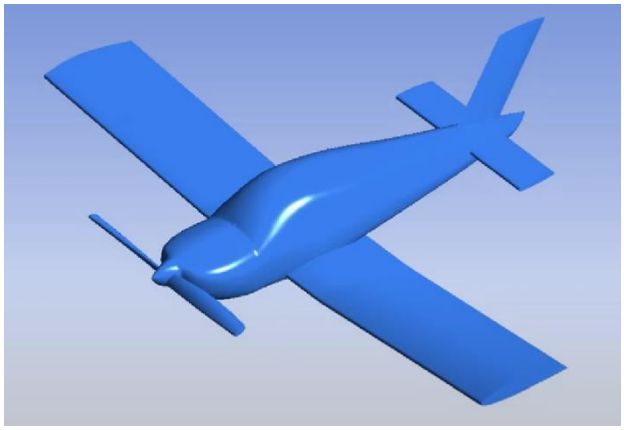


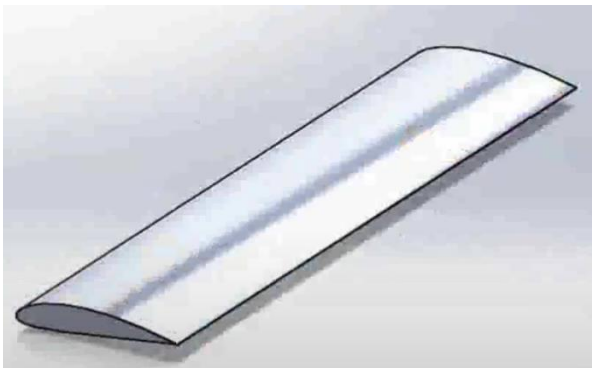
Optimization via CFD Simulations

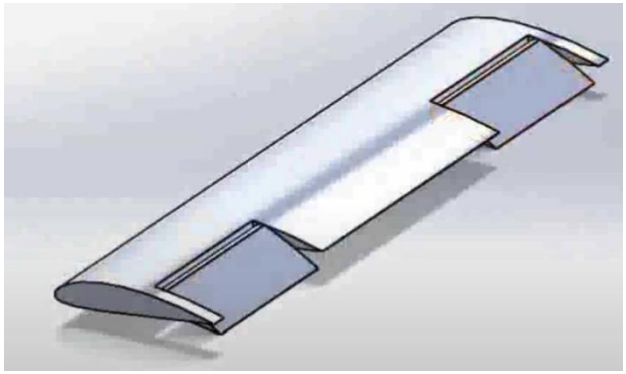
- **Software Used:** ANSYS Fluent
- **Parameters Analyzed:** Lift and drag at various angles of attack.

AOA Values Tested: 15°, 25°, 45°, -25°









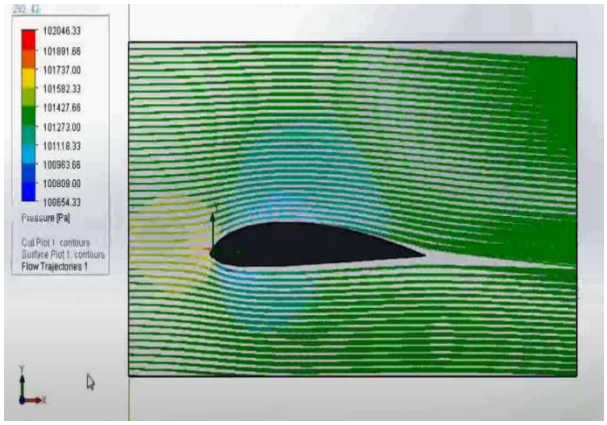
Wing Parameters:

- Chord: 80mm
- Wing Span: 400mm
- Speed of Air: 35m/s

Results and Analysis

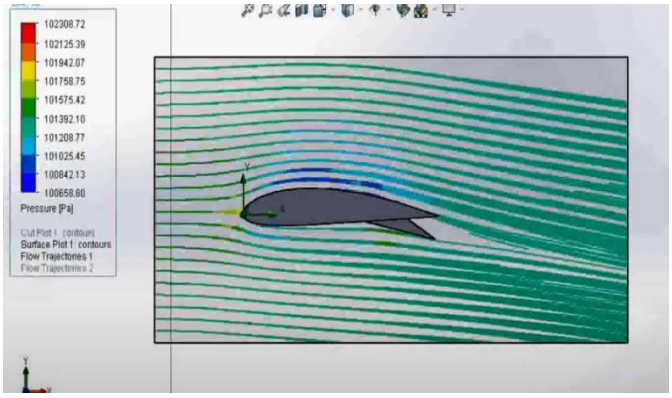
- **AOA 0°:** Flow at 0°
  - **Min Lift:** 2.647N, **Max Lift:** 2.761N, **Avg Lift:** 2.708N
  - **Drag:** 0.05

Observations: At 0°, the aircraft demonstrated a balanced lift-to-drag ratio, indicating efficient gliding performance. The flow remained attached to the wing surface, minimizing drag.



- **AOA 15°:** Flow at 15°
  - **Min Lift:** 5.097N, **Max Lift:** 5.242N, **Avg Lift:** 5.175N
  - **Drag:** 0.05

Observations: At 15°, the aircraft demonstrated a balanced lift-to-drag ratio, indicating efficient gliding performance. The flow remained attached to the wing surface, minimizing drag.



- **AOA 25°:** Flow at 25°
    - **Min Lift:** 6.857 N, **Max Lift:** 7.019 N, **Avg Lift:** 6.942 N
    - **Drag:** 0.15

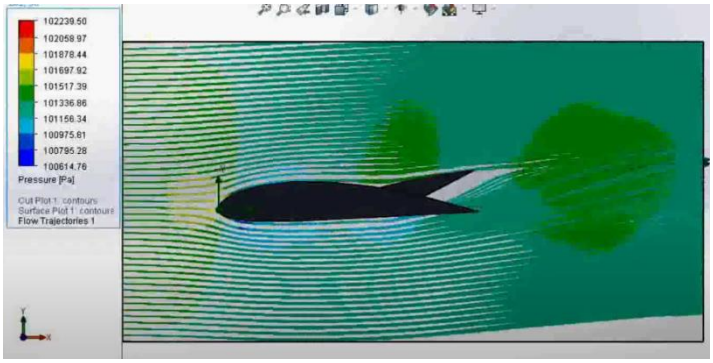
Observations: At 25°, there was a noticeable increase in lift, but also a significant rise in drag. The flow began to separate at the trailing edge, causing increased turbulence.

- **AOA 45°:** Flow at 45°
    - **Min Lift:** 8.629N, **Max Lift:** 8.719N, **Avg Lift:** 8.687N
    - **Drag:** 0.3

Observations: At 45°, the lift peaked, but the drag reached its maximum. The flow separation was extensive, leading to a large wake region behind the wing.

- **AOA -25°:** Flow at -25°
    - **Min Lift:** -2.121N, **Max Lift:** -1.996N, **Avg Lift:** -2.050N
    - **Drag:** 0.1

    Observations: At -25°, the lift was negative, indicating a downward force. The drag was moderate, and the flow separation was less severe compared to positive AOAs.



Conclusion

The CFD simulations provided valuable insights into the aerodynamic performance of the RC aircraft model at different angles of attack. The optimized design demonstrated improved gliding performance, which can be further refined for practical applications.

Future Work

Further Optimization: Explore additional AOA values and other aerodynamic parameters.
Prototype Testing: Conduct real-world flight tests to validate simulation results.
Material Improvements: Investigate the use of different materials to enhance performance and durability.