

Enhancing Experimental Aircraft Aerodynamics

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Introduction

Our project was to improve the aerodynamics of experimental aircraft. For this project we focused on improving the aerodynamics of the landing gear system. To do this we used CFD and Stress analysis tools to find the optimal designs. We then manufactured and tested the fairings on the plane to verify a reduction in drag and increased speed. Our design goals are listed below.

- Reduce drag
- Simple manufacturing
- Ability to be removed
- Cost-effective.

CFD Analysis

Ansys Fluent was used for analysis. We used optimal flight conditions as parameters for airflow settings. This analysis gave us confidence in our designs.

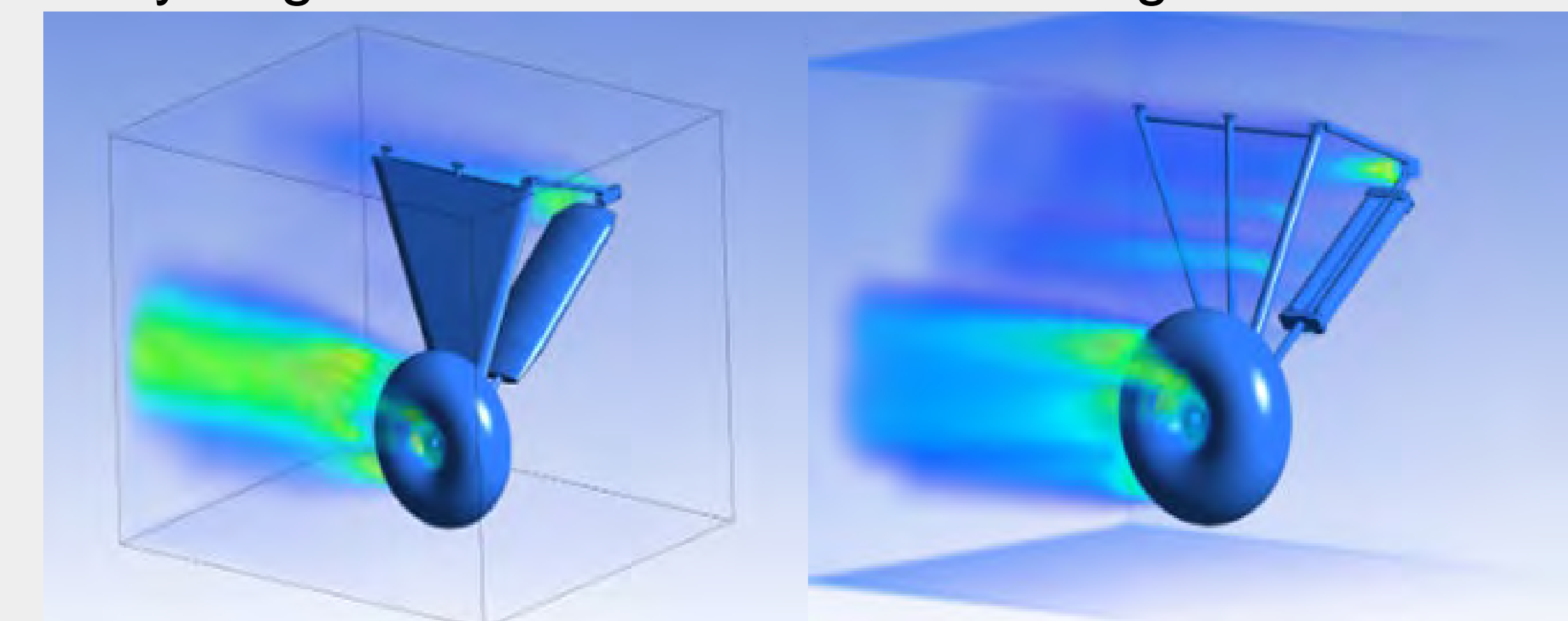


Figure 1: CFD models showing the change in flow from the landing gear with and without the fairings.

Structural Analysis

With the information from the CFD analysis, structural and modal analyses were performed to ensure our designs were strong enough to endure flight conditions.

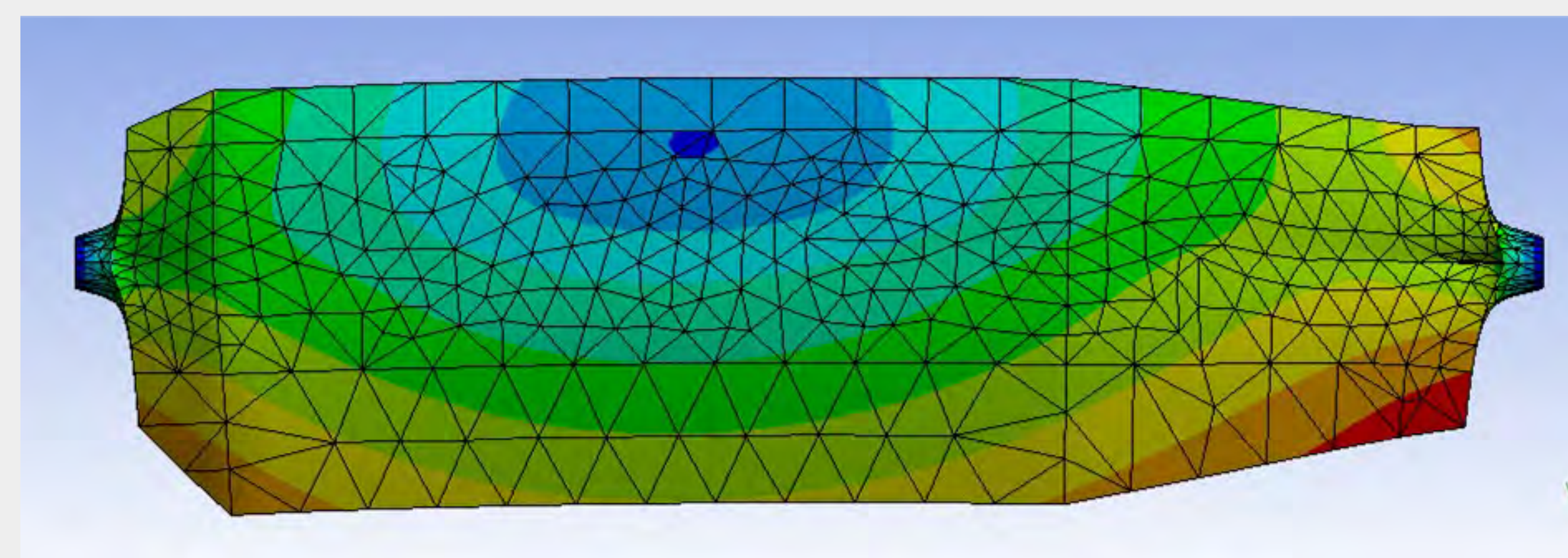


Figure 2: FEA model of the shock fairing showing the maximum expected deformation.



Figure 3: Experimental aircraft with uncovered landing gear



Figure 4: CAD image of the designed fairings (transparent parts) and the original landing gear visible. Mounting brackets in pink.



Figure 5: Experimental aircraft with designed fairings attached

Results

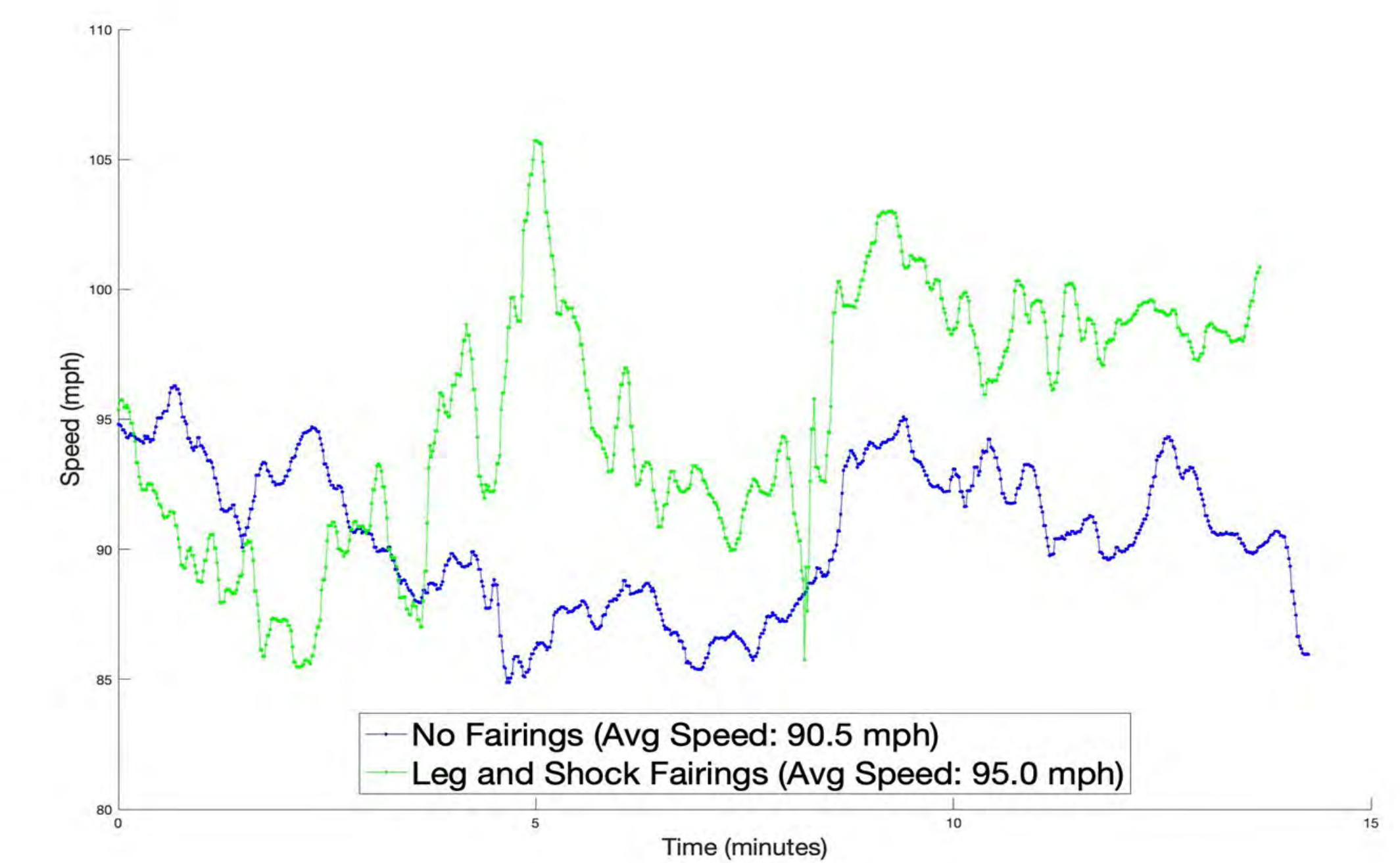


Figure 6: Speed data shown from test flights comparing the uncovered and covered landing gear.

Metric	Goal	Result
CFD Drag Reduction	10%	21.9 %
Total Weight	15 lbs	9 lbs
Total Cost	< \$500	\$313.92
MPH Increase	2-3	4.5

Table 1: Design specifications and their results

Conclusion

Based on data from the test flight and feedback from the pilot, the fairings performed well. They provided a significant increase in speed. The pilot noted no change in handling or control from the fairings. The change in fuel consumption was inconclusive due to the short distance of the test flight. A long distance test flight would provide more conclusive fuel consumption data.

The exposed wheels are the largest contributor of drag. Analyses were performed on various designs but with resource constraints, the design process remains at the analysis stage. Further performance improvements are to be expected with a return to this analysis and exploration of the design concepts.