



# Aerodynamic Optimisation and Design of the Rear Wing of a Formula 3 Sprint Car

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## Introduction

Wings have been used in motorsport since the 1960s. They are used to create downforce, allowing cars to travel quicker around corners.

This projects focus was to look at the current design of the rear wing on SBDs F3 sprint car to analyze and optimize it.

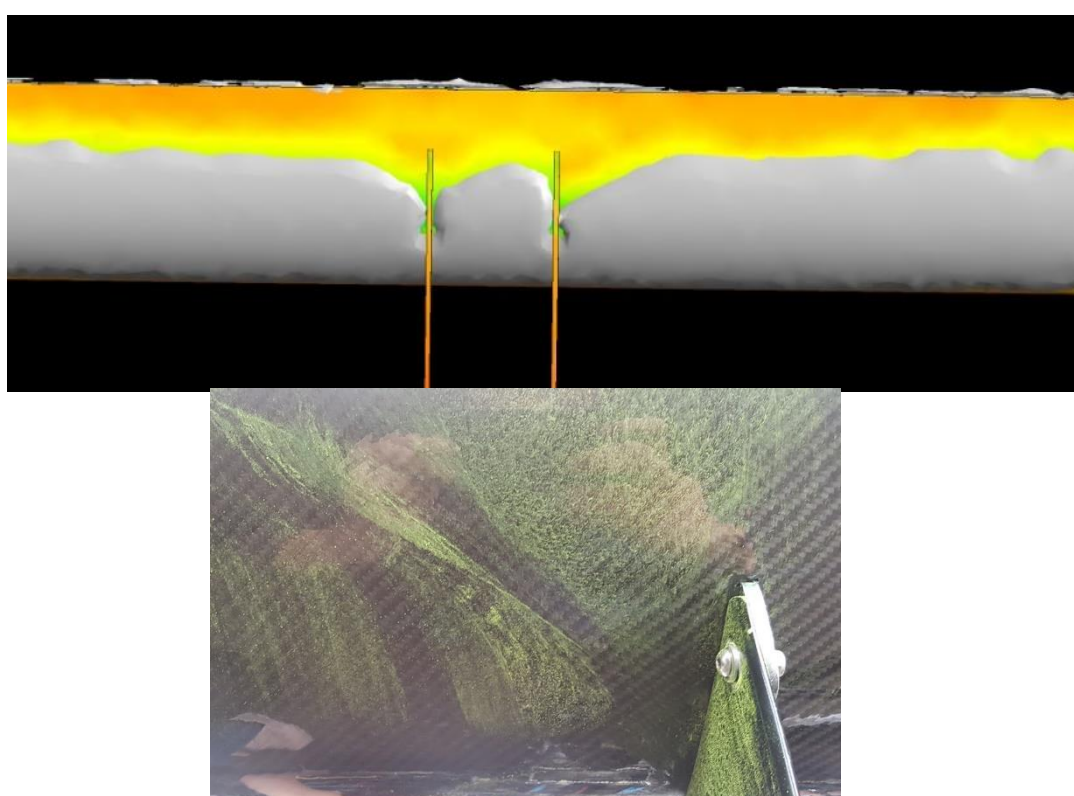
The main aim of this project was to see how the current design performed and if certain areas could be improved with regards to efficiency of the wing while keeping the car in a drivable state as to not effect the center of pressure too much.



SBD F3 Sprint Car

## Real World Validation

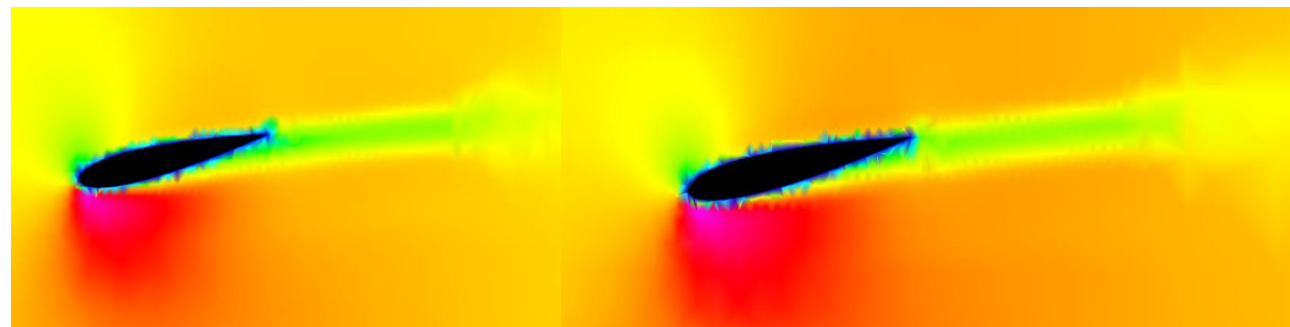
To ensure the accuracy of the CFD testing real world tests were used to compare against the CFD result, ensuring the settings being used could produce accurate results.



MCR Flow Vis Comparison

Flow Vis was used to compare the flow structures in CFD against those produced in real life. By doing this the results being produced can be trusted to be used without further real world testing. Wind tunnel testing was also done to investigate

how different turbulence models are required when separation starts to occur.

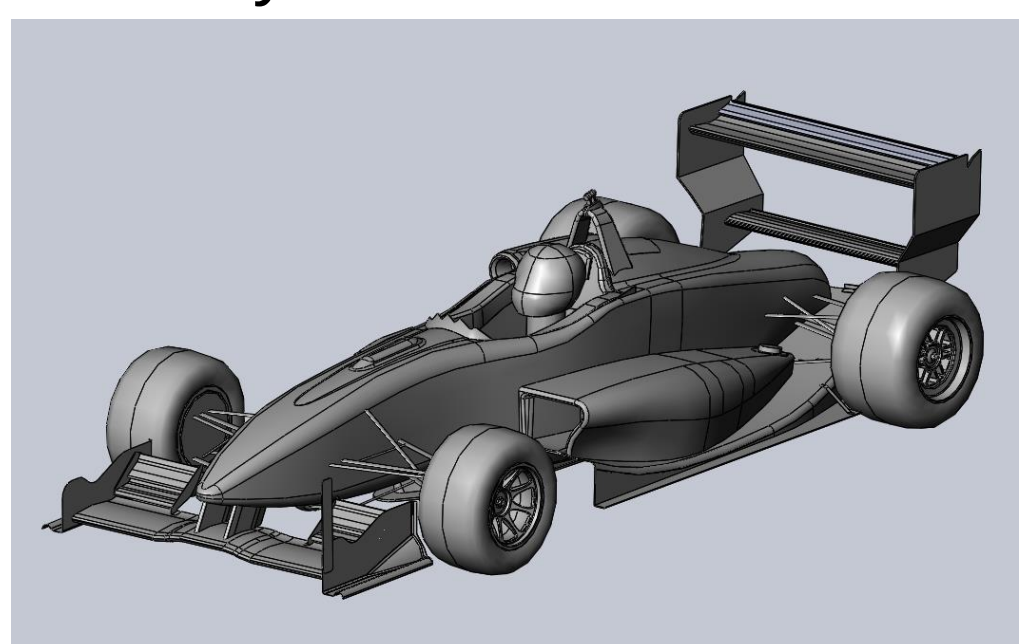


Comparison of K Epsilon and K Omega for NACA 0012 profile

## Baseline Geometry

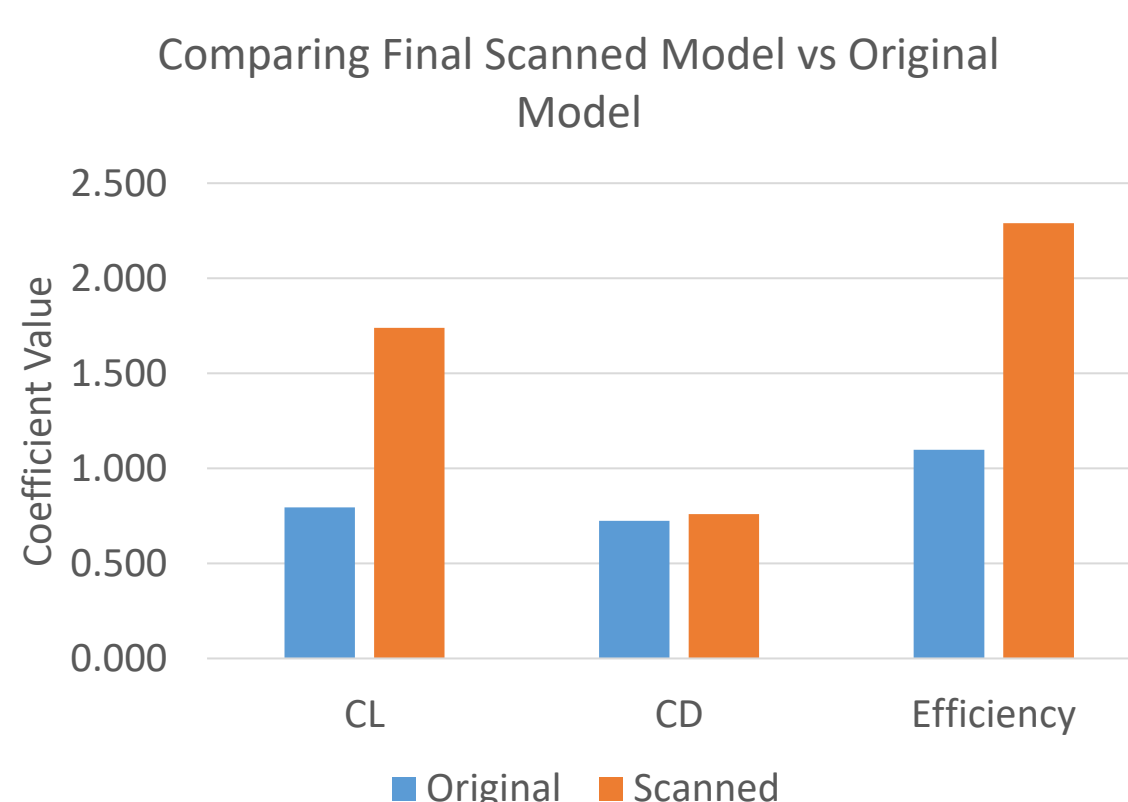
To ensure accurate results with the full car model the CAD model had to be as accurate as possible. An original model was created from a modified version of a F4 car.

The car was then scanned for a more accurate CAD model to be created, the front and rear wings were made from actual measurements to improve their accuracy.



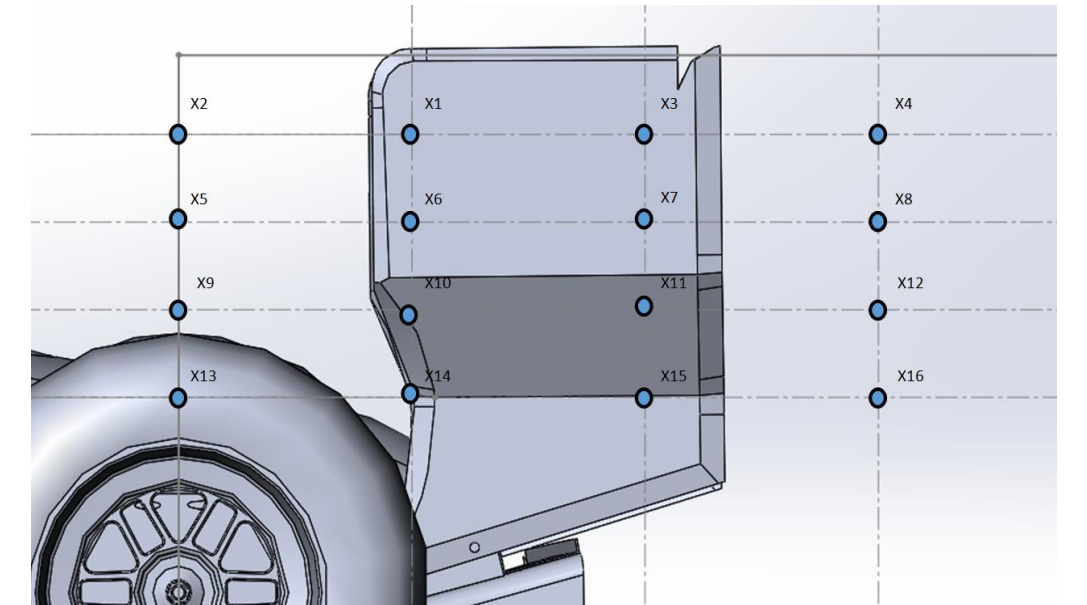
F3 Car Final CAD Model

The graph below shows why an accurate CAD model is required to ensure accurate results.



## Isolated Wing Studies

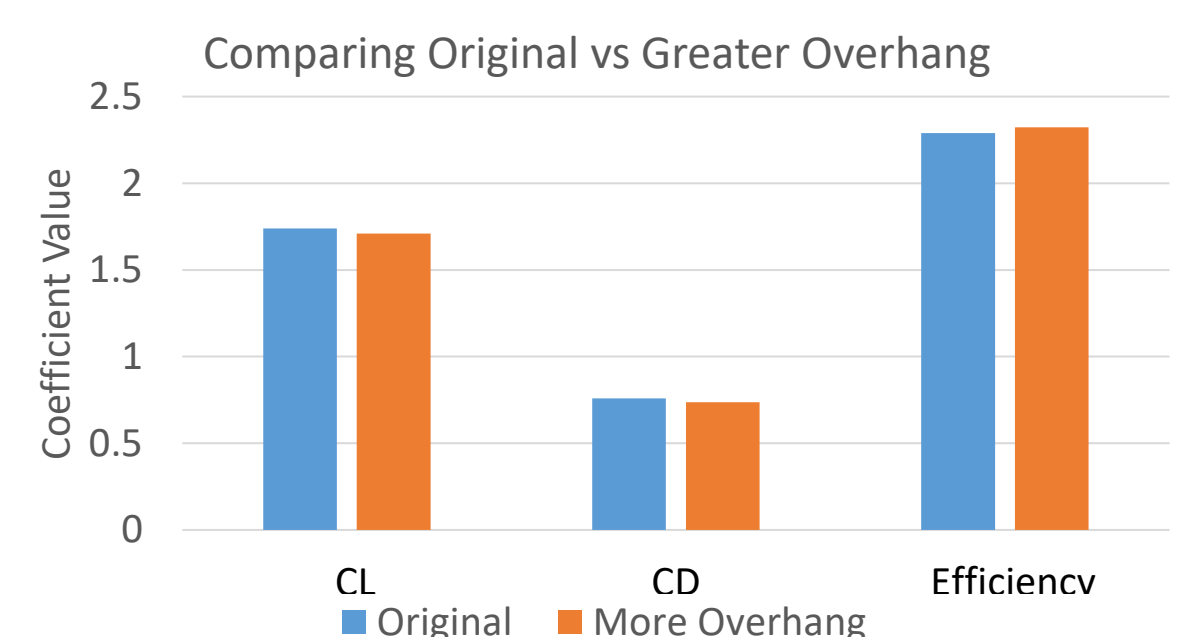
To run as many tests as possible in the given time the wing studies were conducted in isolation using a resultant velocity to replicate the car being in front of the wing. These studies included wing angle, position, gap and overhang.



Wing Position Locations

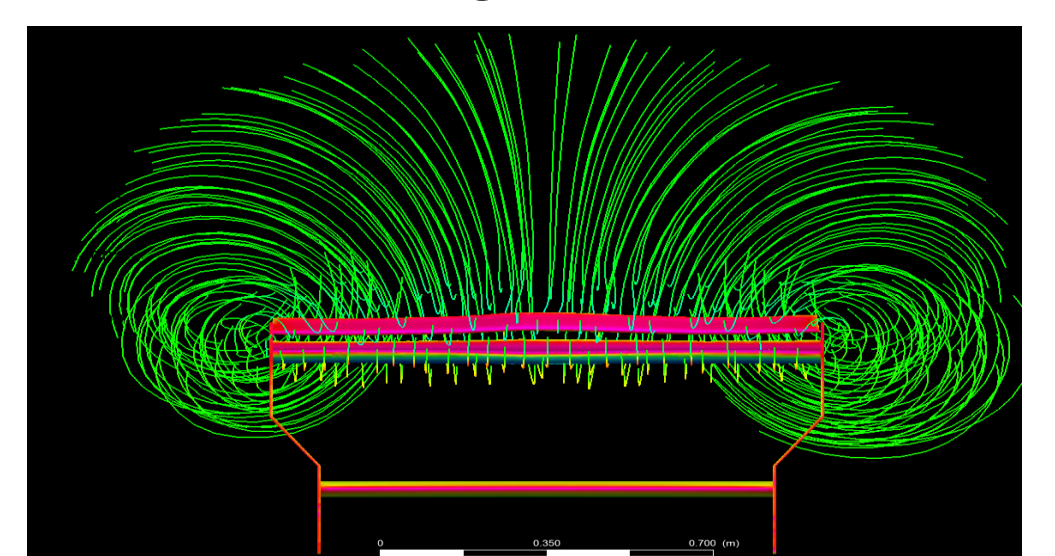
Figure x shows all the locations tested to gain more understanding of how the wing position effects performance.

Changing the overhang on the wing for found to improve the performance of the wing but negatively impacted the CoP of the overall car.



## Twisted Wing

A twisted wing design was created to try and improve the performance of the wing by twisting it according to the airflow being produced by the wing. While unfortunately not working as well as the current design future improvements could be made to make this design more efficient.



Twisted Wing CFD

## Acknowledgements

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Finally I would like to thank my friends and family for their support throughout my education.