



Aerodynamic Development of the Storm Drag Bike using Computational Fluid Dynamics

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Introduction

This project investigates and develops the aerodynamic characteristics of the Storm drag bike. Storm asked UWTSD Swansea if a student would like to improve the fairing of their drag bike aerodynamically. The main objective was to increase the downforce to allow Storm to increase the power of the bike to achieve faster times down the drag strip. The project looks at the principals of aerodynamics, and research was completed to see what methods can be used to improve any areas of concern. The geometry was then developed to analyse the gains, if any, in drag, lift and efficiency.

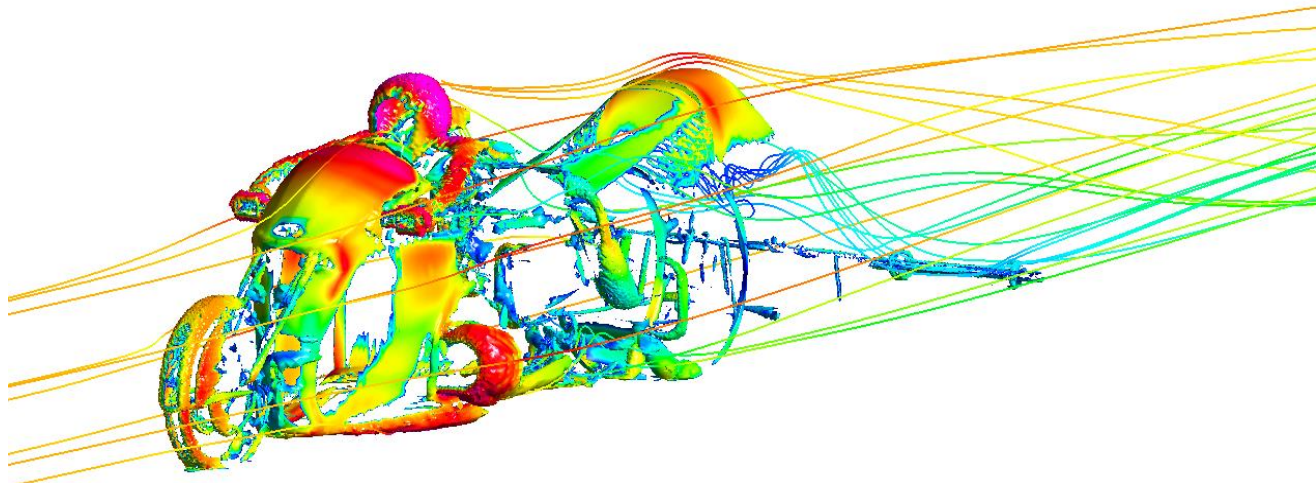
Project Aims

- Increase Downforce
- Reduce the Drag Force
- Improve the Efficiency of the Geometry.

Methodology

Research current aerodynamic profiles for geometry development. Use Solidworks surfacing methods to implement complex geometry changes. Once geometry developments were finalized, analysis was completed via computational fluid dynamics . The results were analysed through post processing to visually view characteristics such as pressure contours, velocity contours, streamlines, velocity vectors and turbulence.

Figure 1 – Post Processing of Final Geometry



Geometry Development from Start to Finish

Figure 2 – Geometry Developments



Results

Comparing the realistic geometry to the developed geometry, the coefficient of drag reduced by 29.65% which has relieved 192.8N of drag force. The coefficient of downforce increased by 69.05% which has added nearly 40N of downforce to the drag bike. This equates to a 12.23% rise in efficiency, with a total of 21% geometrical efficiency.

Table 1 – Geometry Development Results

Total Results						
Model	Cd	Drag Force (N)	Cl	-Cl	Downforce (N)	Efficiency (%)
Realistic	0.6770	650.38	-0.05900	0.05900	56.68	9
Modified Fender	0.6170	592.74	-0.07270	0.07270	69.84	12
Air Inlet Mk1	0.5660	543.74	-0.02460	0.02460	23.63	4
Air Inlet Mk2	0.5740	551.43	-0.06550	0.06550	62.92	11
Air Inlet Mk3	0.5510	529.33	-0.07030	0.07030	67.54	13
Full Covers	0.5705	548.07	-0.06160	0.06160	59.18	11
Full, Bar Top + Bottom	0.5650	542.78	-0.03620	0.03620	34.78	6
Full, Bar Bottom	0.5950	571.60	-0.03740	0.03740	35.93	6
Full, Bar Top	0.4410	423.66	-0.05070	0.05070	48.71	11
New Front Fairing	0.5568	534.91	-0.02670	0.02670	25.65	5
Filled Body	0.5375	516.36	-0.02440	0.02440	23.44	5
Filled Body New Flaps	0.5447	523.28	-0.03150	0.03150	30.26	6
Short Rounded Tail	0.4961	476.59	-0.09822	0.09822	94.36	20
Short Rounded Tail Mk2	0.4962	476.69	-0.09820	0.09820	94.34	20
Hyabusa Tail	0.4763	457.57	-0.09974	0.09974	95.82	21
Hyabusa Tail +50mm	0.4800	461.13	-0.08308	0.08308	79.81	17
Hyabusa Tail +100mm	0.5016	481.88	-0.08532	0.08532	81.96	17
Hyabusa Tail +150mm	0.4978	478.23	-0.09062	0.09062	87.06	18
Hyabusa Tail +200mm	0.5093	489.27	-0.08786	0.08786	84.41	17

Graph 1 – Downforce Coefficient Results for all Developments

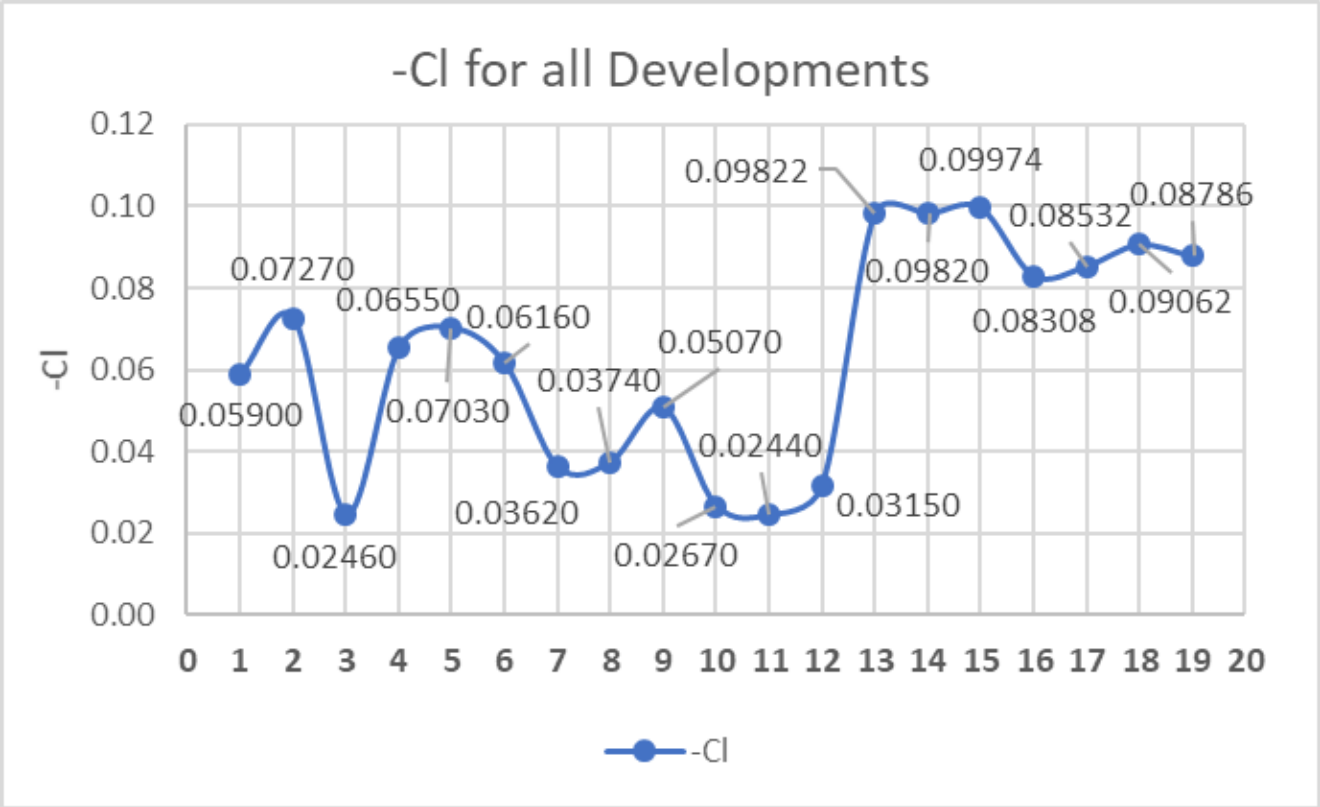


Figure 3 – Wake Region Velocity Contour Comparison

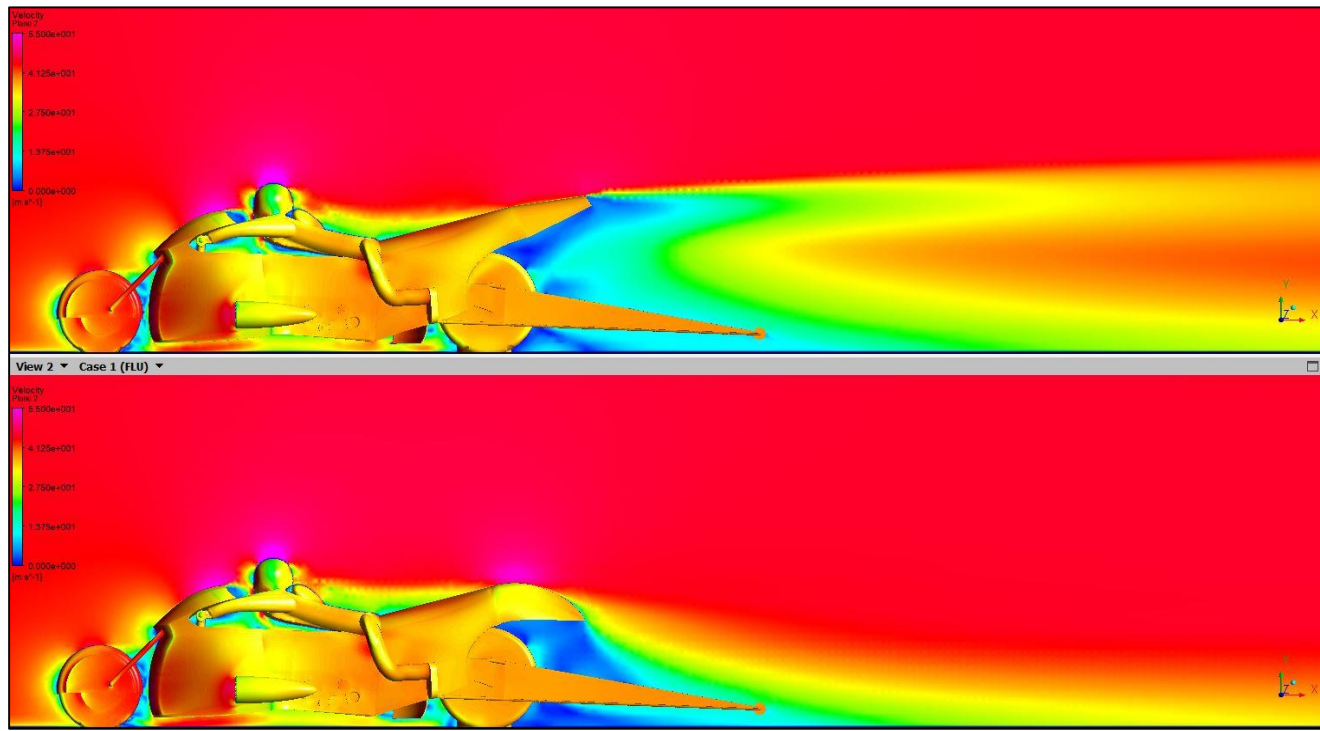
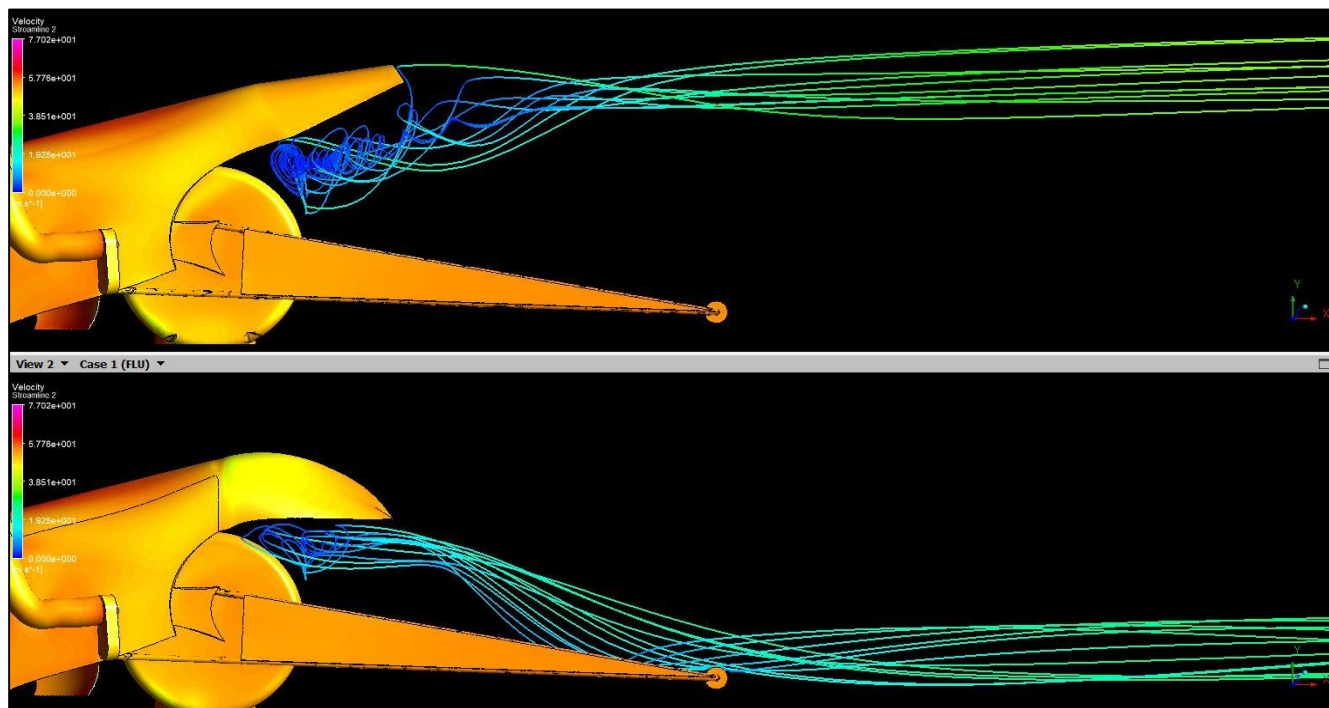


Figure 4 – Under Tail Streamline Comparison



Conclusions

The aims that were set have been achieved. These achievements were mostly due to the development of the tail, which was inspired by the iconic, aerodynamically designed Suzuki Hayabusa. However these results should to be verified with wind tunnel data.