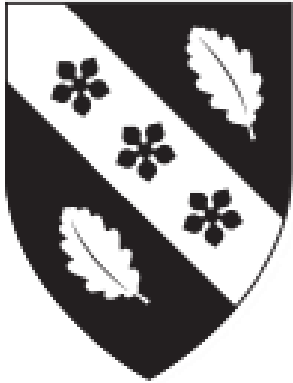


19/11/22



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Evolution of aerodynamics in Motorsport

Ryan Boardman (2203353)

Academic skills – Technical report writing
(ACHA4005)

Contents Page

Page 2 - introduction

- **Figure 1**

Page 3 – What is aerodynamics and how does it work?

- **Figure 2**

The Beginning

- **Figure 3**

Page 4 – Aerodynamics in motorsport

Page 5 – What will aerodynamics be like in future?

- **Figure4**
- **Conclusion**

Page 6 - References

Introduction

In this technical report it will look at how the study and advancement in aerodynamics has changed throughout time. It will look at in depth research at the implementation of aerodynamics in motorsport and how it is utilised from past to present day and what to expect in future. It will show an understanding on how important the study of aerodynamics is to motorsports, especially across certain types of motorsport series. This technical report aims to show an understanding in how aerodynamics started and how it is being used throughout the years from the beginning to how it is in the present day. It will also aim to show the development in the aerodynamics throughout the years giving examples from multiple categories of the motorsport tree. It will go from how it started and the first discoveries of aero, to what further development and study has made it what it is today. The report will go through steps of development from past to present to highlight the ways it has developed as time went on and as the study went to further depths and breakthroughs. The report will also include relevant figures to show back up the findings from development whether it be showcasing components or through graphs or wind tunnel simulation. This report will also showcase the relevant tools that are used within the aerodynamics department of motorsports, this will present this by showing how it has been advanced and fine tuned through time from past to current day.

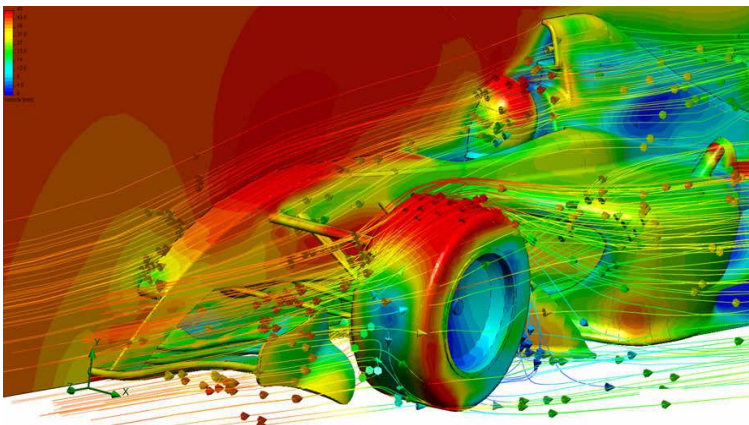


Figure 1: (showcasing an example of CFD testing to give a visual representation of airflow) [[This Is How Aerodynamics Has Changed Over 100 Years Of Indy \(wonderfulengineering.com\)](https://www.wonderfulengineering.com/this-is-how-aerodynamics-has-changed-over-100-years-of-indy/)]

What is aerodynamics and how does it work?

To put it simply aerodynamics is the science of airflow moving through solid objects. (Anon.,) In this case it is how it flows through and around a motor vehicle/race car. It works by using aero components such as wings, venturi tunnels, splitters etc, to name a few. Components like these are used to manipulate airflow to certain parts of the car to enhance how streamline it is to cut through air with the least amount of drag as possible to improve speed. It can also be used to force certain components to have increased air pressure so that they do their job better, for example venturi tunnels work by forcing air under the car and through these tunnels located on the floor of the car. They work by inviting the low-pressure air in and as it flows into these venturi tunnels, it makes that low pressure air turn into high pressure air by making the low-pressure air work between the cars floor and the tracks surface, which essentially pulls the car to the track increasing grip using an aerodynamical force called downforce. "Gary Anderson: What 2022-style F1 ground effect looks like." 25 Jan. 2022, <https://the-race.com/formula-1/gary-anderson-what-2022-style-f1-ground-effect-looks-like/>. However, you do not want too much downforce as it can cause drag which will have an effect on the straight line speed of the car.

The Beginning

In the early years of motorsport aerodynamics was not a major thought as there was not much if any knowledge on the subject. Therefore you see the first models of cars/ race cars be very high and box shaped in design. Obviously from knowledge that we've gained with todays technology and understandings of aero this is not ideal, especially from a motorsport engineering point of view. However, despite this in 1899 a steam powered car which had the name of the 'La jamais contente' which was lightweight weighing in at 3,200lbs and quite powerful for a machine of its time producing 62horsepower, and it was a made with the intent of speed, being very streamlined yet the driver was still very much obstructing the airflow.

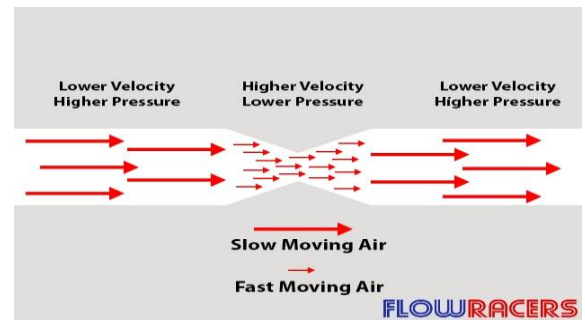


Figure 2: displaying the effect of venturi tunnels. [[What Are Venturi Tunnels In F1? \(Venturi Effect Explained\) – FLOW RACERS](#)]

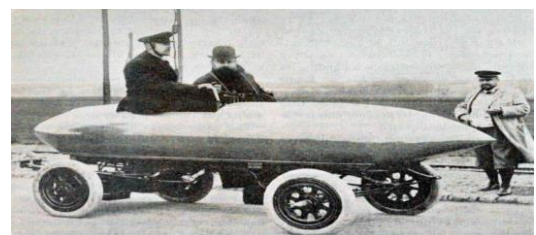


Figure 3: (picture showcasing the 'la jamais contente') [[\[À l'origine\] La Jamais Contente : la voiture électrique qui a dépassé les 100 km/h... en 1899 \(novethic.fr\)](#)]

Aerodynamics in motorsport

In motorsports aerodynamics especially in the modern era plays a huge part in making a fast car. In the early stages of motorsport aerodynamics wasn't as developed as it is today due to the lack of knowledge on the study and lack of the advanced technology. However, it was still considered. For example, in the 1960s the cars were low to the floor with low seating positions and a low surface area car to increase how streamlined the cars were. In 1968 we saw the first introduction of wings used on the cars, as knowledge on the subject started to take its shape. [[The first appearance of wings on Formula 1 cars \(motorsport.com\)](#)] From these developments aerodynamics only started to advance further. When it got to the 1970s it was seen that engineers started to gain more knowledge of the subject and were able to further advance the cars as obvious by the bigger and more prominent wings on the rear and front of the car. These wings would produce more downforce making the cars more capable of taking corners at faster speeds making the overall performance of the cars better and much quicker. From 1977 to 1982 the development of ground effect was introduced [[Ground Effect in Formula 1 is back: All the Facts - Motorsport Explained](#)] this can be seen from the early use of venturi tunnels and diffusers, this was even taken further when 'Brabham' made the 'BT46' also known as 'the fan car' as it used a fan to increase the effect of the ground effect on the car, it was banned after just competing in one race of which it won. [[Banned: The full story behind Brabham's F1 'fan car' \(motorsport.com\)](#)] Ground effect and venturi tunnels was later banned by the FIA (Fédération Internationale de l'Automobile) in 1982. ([Collantine](#),). With more modern F1 cars the aerodynamics is some of the most advanced it has ever been with the introduction of venturi tunnels again from the 2022 season, and with the complex design of the front and rear wings. These more advanced wings in the current day make for some of the fastest race cars to ever be produced. Modern F1 cars also produce extreme levels of downforce (around 3500kgs or 34,335 Newtons). These kinds of advancements are due to an extreme advance in the highly advanced technology that contributes to aerodynamic development. Technologies such as wind tunnels help with knowing how the air will act on the car before it even hits the track, which benefits engineers and teams so they can make tweaks and make their components as perfect as possible. Also software such as CFD is used to run aero simulations again to make the aero components as perfect and tailored to the car as possible.

What will aerodynamics be like in future?

The future of aerodynamics looks bright, as technology advances so will the aerodynamics of cars. Manufacturers and motorsport teams will forever keep developing the aerodynamics of their cars especially their future ones. This means that more advanced components and ways of designing these aero components will make up for the most technological advanced cars to ever be produced. Motorsport teams and manufacturers in future will produce aero designs so advanced in order to make the fastest and most streamlined cars with huge amounts of mechanical grip that it is beyond our imagination as of right now, however it gives something very exciting to look forward to in the aerodynamics design industry. Motorsports such as Formula One make a big push to develop cars at rapid rates so it will only be a matter of time that we see new ways of aerodynamic design to enhance their speeds and how well their on-track performances. Car manufacturers also compete with each other in certain aspects especially in the supercar industry, where these manufacturers compete to make the fastest production cars on the market, where aerodynamics can make all the difference and its certain these manufacturers will keep this up in future.

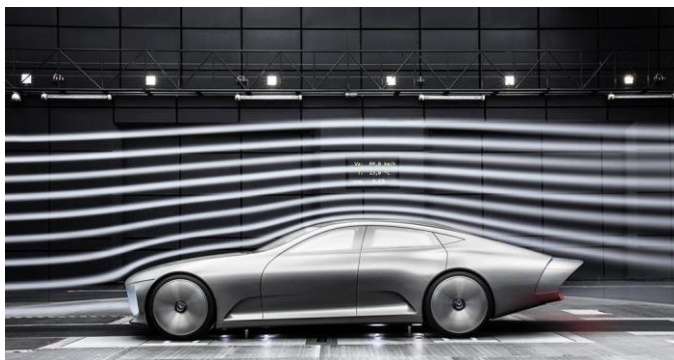


Figure 4 showing a concept of aero in future. [\[\[Sponsored\] How active aerodynamics will shape car design | Article | Car Design News\]](#)

Conclusion

To conclude aerodynamics has shown its effective evolution physically especially in sports like F1. It highlights how the beginning of aerodynamics set a baseline for these advancements to take place. These advancements have been shown to be very successful as it has led to the production of some of the fastest race cars in the modern day.

References

Anon., . *Aerodynamics*. [Online]

Available at: <http://www.livescience.com/47930-what-is-aerodynamics.html>

[Accessed 23 11 2022].

Anon., . *Aerodynamics in racing*. [Online]

Available at: <http://www.f1technical.net/articles/10>

[Accessed 23 11 2022].

Collantine, K., . *Banned: Ground effect*. [Online]

Available at: <http://www.f1fanatic.co.uk/2007/06/07/banned-ground-effects/>

[Accessed 23 11 2022].

Donut Media., . *The evolution of Aerodynamics*. [Online]

Available at: [\(19548\) The EVOLUTION of Aerodynamics - YouTube](#) [Accessed 23 11 2022].

Gary Anderson., . *Venturi tunnels* [Online]

Available at: , <https://the-race.com/formula-1/gary-anderson-what-2022-style-f1-ground-effect-looks-like/>

[Accessed 23 11 2022].

Rene Fagnan., . *Wings first introduced*[Online]

Available at: [The first appearance of wings on Formula 1 cars \(motorsport.com\)](#)

[Accessed 23 11 2022].

Matt Somerfield., . *Banned brabham BT46 'Fan Car'* Online]

Available at: [Banned: The full story behind Brabham's F1 'fan car' \(motorsport.com\)](#)

[Accessed 23 11 2022].