



Aerodynamics within motorsport

Isaac Revans

Andrew Noble

Wales Institute for Science & Art

Motorsport Engineering

Intro

This poster is about the uses of aerodynamics on cars within motorsport and how it has affected racing throughout the years.

It plays an important role within racing, influencing speed, handling, stability, fuel efficiency and tyre wear. By manipulating airflow, engineers have managed to optimize downforce and minimize drag.

It has been developed throughout time from simple smooth bodywork to the intricate designs we see today in modern racing cars such as formula one.

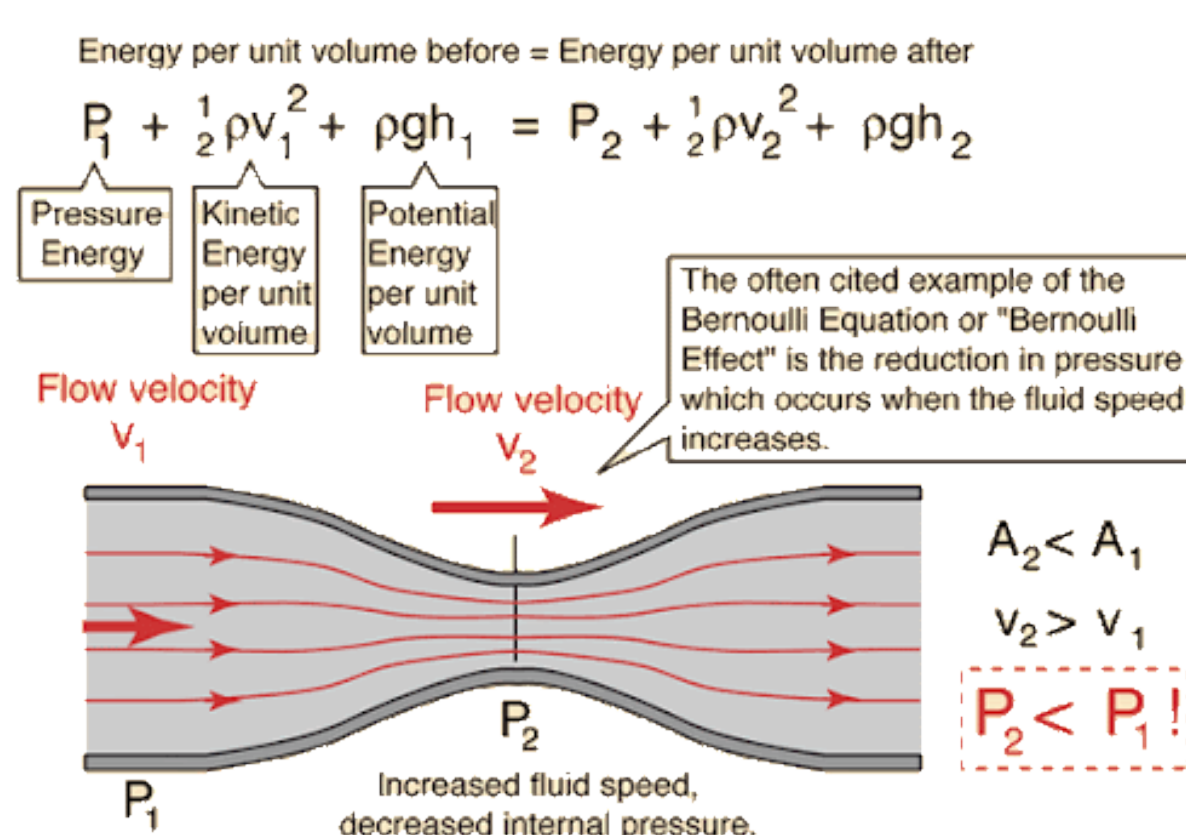
Bernoulli's Theorem

Bernoulli's theorem has helped change the way we calculate and design aerodynamic through the laws of thermodynamics.

It is a fundamental concept in fluid dynamics, describing the behaviour of a fluid (air & water) moving along streamline.

$$P_{\text{Static}} + \frac{1}{2} \rho v^2 + \rho gh = \text{CONSTANT}$$

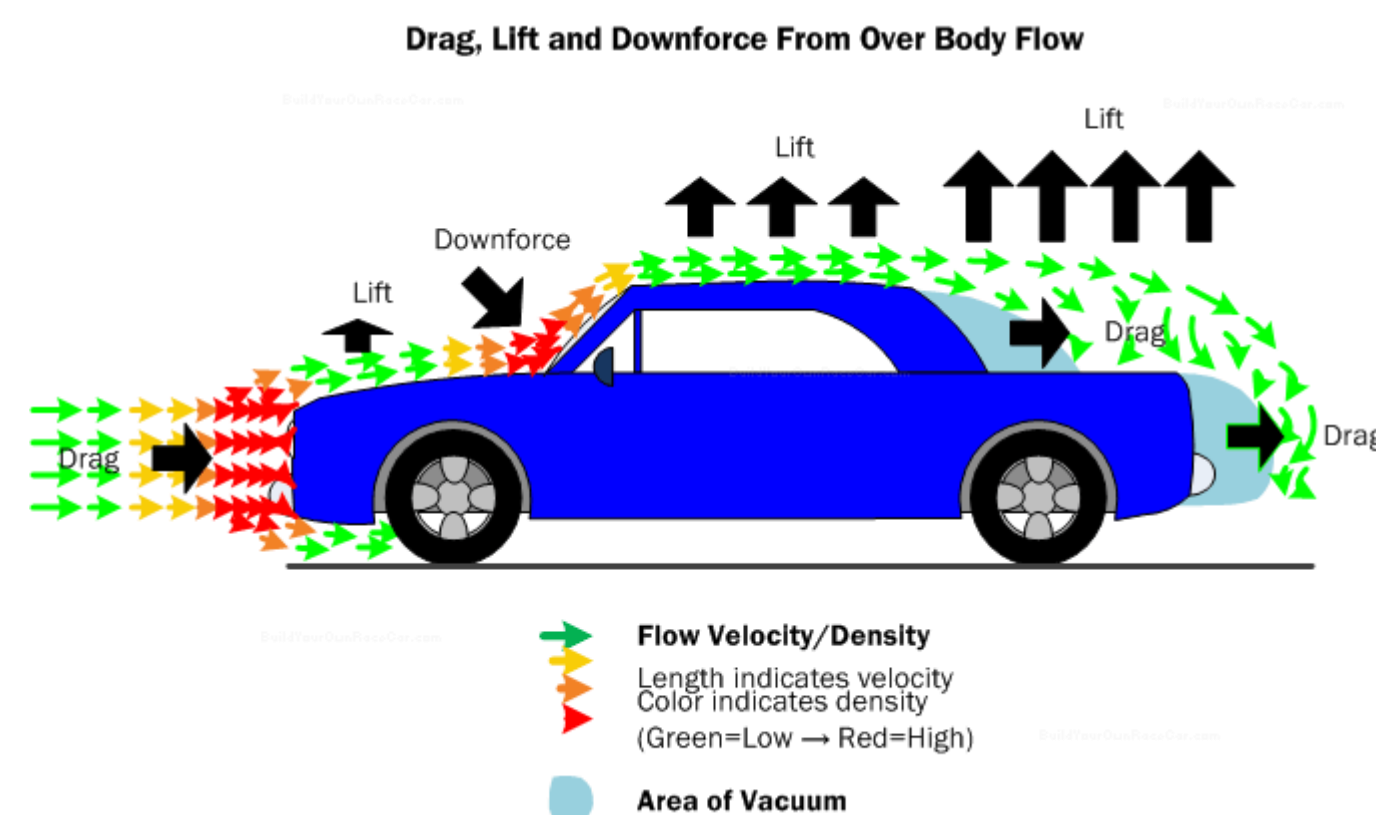
As fluid moves through a channel, if it **speeds up** the pressure must **decrease**, if it **slows down** the **pressure increases**.



Nave, R. (2019). *Bernoulli Equation*. [online] Gsu.edu. Available at: <http://hyperphysics.phy-astr.gsu.edu/hbase/pber.html>.

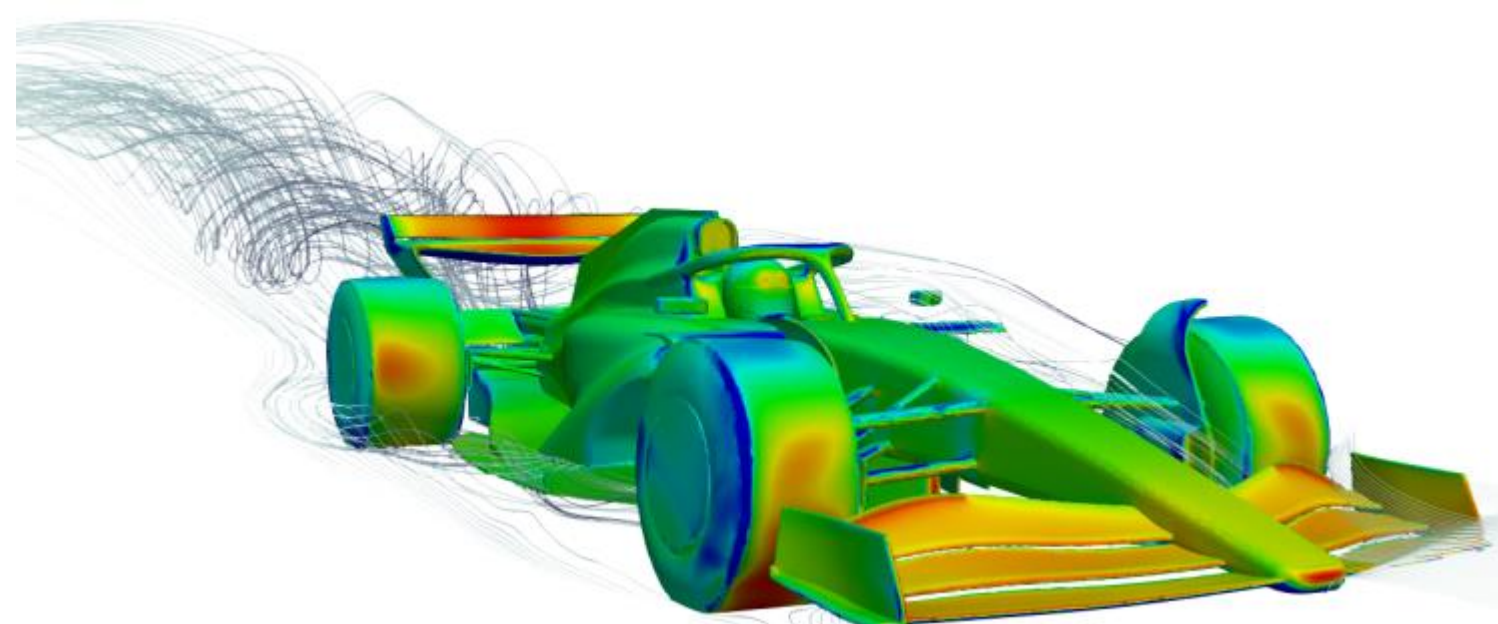
What is drag?

Drag is the resistive aerodynamic force. It is made up of three elements: frontal pressure, rear vacuum and skin friction.



Build Your Own Race Car! (2015). *Car Aerodynamics Basics, How-To & Design Tips ~ FREE!* [online] Available at: <https://www.buildyourownracecar.com/race-car-aerodynamics-basics-and-design/2/>.

Drag on a vehicle is increased when the resistive force of the air can have more sharper faces to push against. Engineers have designed different bodywork to help avoid frontal drag to prevent it from affecting the speed of the vehicle, and use it for downforce creating wings for the wind to put pressure onto, forcing the car onto the ground.



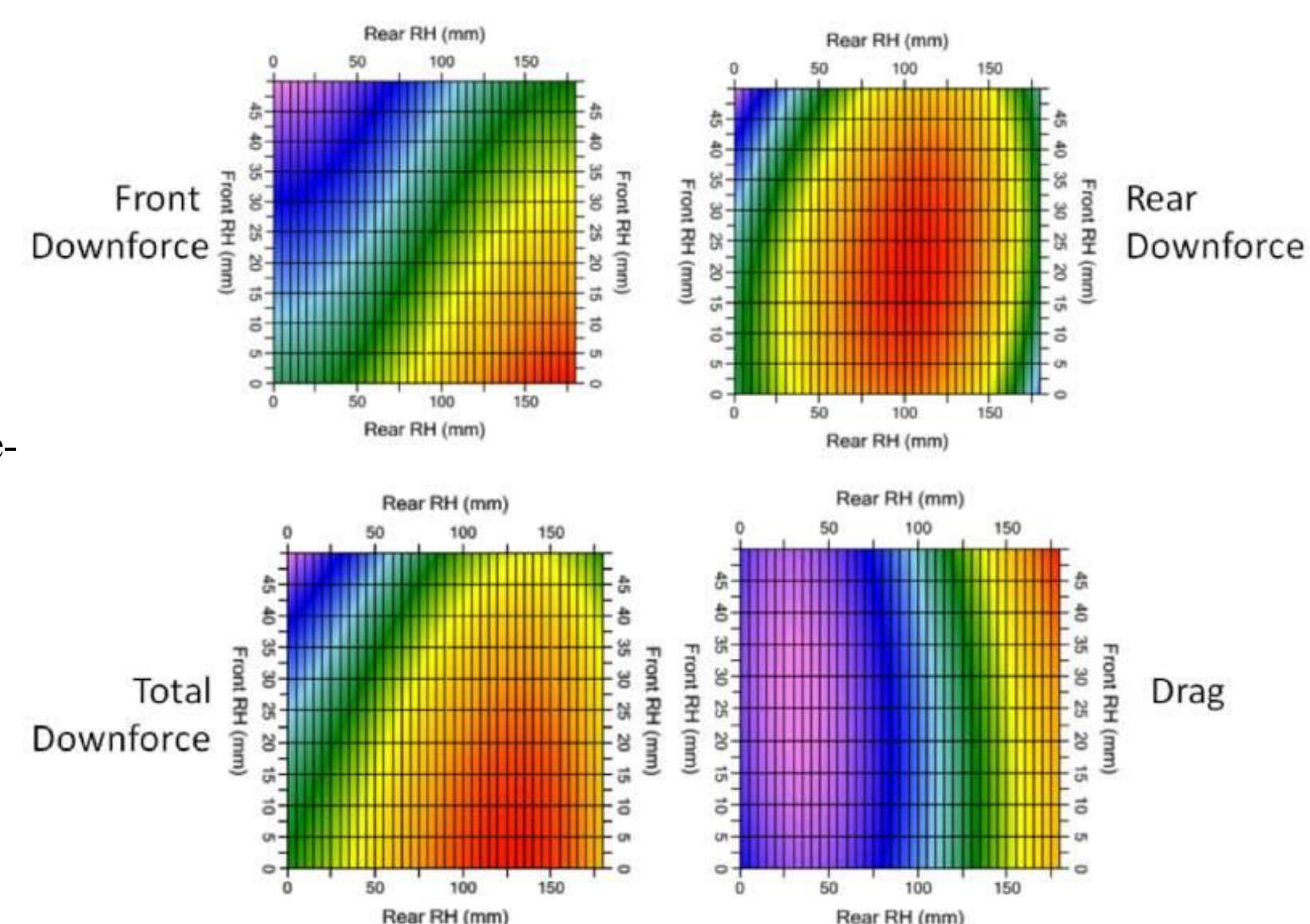
Taylor, M. (2022). *Aerodynamic Studies of a 2022 F1 Car*. [online] Max Taylor - Aerodynamics and Motorsport Engineering. Available at: <https://maxtayloraero.com/2022/01/17/aerodynamic-studies-of-a-2022-f1-car/>.

References

- Taylor, M. (2022). *Aerodynamic Studies of a 2022 F1 Car*. [online] Max Taylor - Aerodynamics and Motorsport Engineering. Available at: <https://maxtayloraero.com/2022/01/17/aerodynamic-studies-of-a-2022-f1-car/>.
- Nave, R. (2019). *Bernoulli Equation*. [online] Gsu.edu. Available at: <http://hyperphysics.phy-astr.gsu.edu/hbase/pber.html>.
- Remmerie, W. (2019). *What is an Aero Map?* [online] Racecar Engineering. Available at: <https://www.racecar-engineering.com/tech-explained/what-is-an-aero-map/>.
- Build Your Own Race Car! (2015). *Car Aerodynamics Basics, How-To & Design Tips ~ FREE!* [online] Available at: <https://www.buildyourownracecar.com/race-car-aerodynamics-basics-and-design/2/>.

Aerodynamic mapping

These 4 aero maps show how slightly changing the can alter the effect of the aero. With the blue showing a low level of downforce, and the red showing a high level of downforce on the front and back of the car. You can also see the total downforce and drag of a formula car.



Remmerie, W. (2019). *What is an Aero Map?* [online] Racecar Engineering. Available at: <https://www.racecar-engineering.com/tech-explained/what-is-an-aero-map/>.

Wind Tunnels

Wind tunnels are used to test different designs for pieces of aero. Simulation wind tunnels can be used to save money, and can easily change the design there instead of making another prototype. These have become a powerful part within motorsport giving new teams an edge over others, where they can test new designs.