





# WHAT IS FORMULA ONE ???

- Highest class of auto racing sanctioned by the Federation Internationale de l'Automobile (FIA)
- It referred to as “The pinnacle of Motor Sports”
- Formula one cars race at high speeds up to 360 km per hour with engines revving up to a formula imposed limit of 18,000 rpm

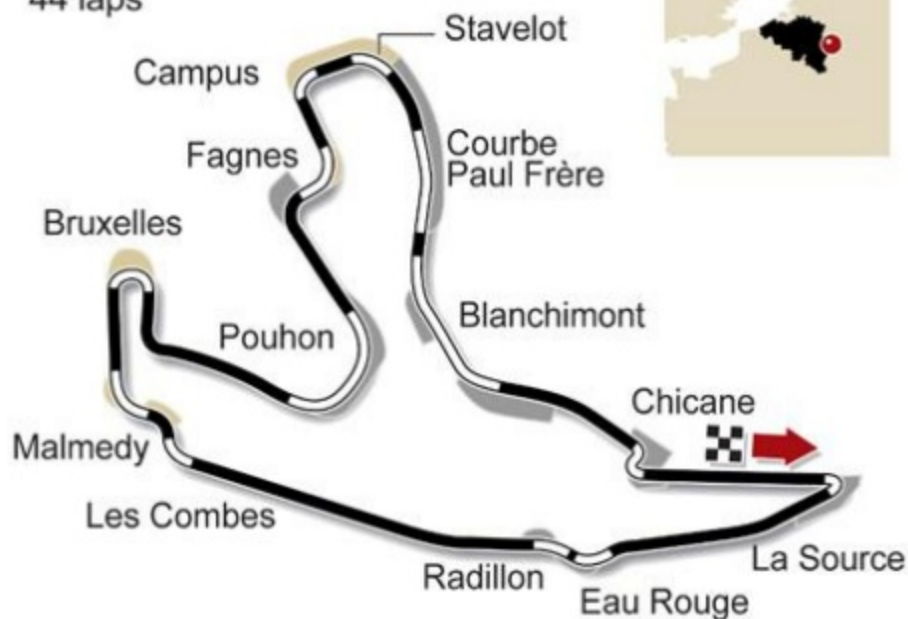
# F1 WORLD CHAMPIONSHIP

- Consists of 2 championships
  - Drivers
  - Constructors
- Upcoming season includes 12 teams and 24 drivers and 20 Grands Prix
- It includes races some of the most iconic tracks like Spa-Francorchamps, Monza, Nurburgring and silverstone

## CIRCUIT DE SPA FRANCORCHAMPS

Circuit: 7.004 km / 4.352 miles

44 laps



## Nurburgring, Germany



## AUTODROMO NAZIONALE DI MONZA

Circuit: 3.600 miles / 5.793 km

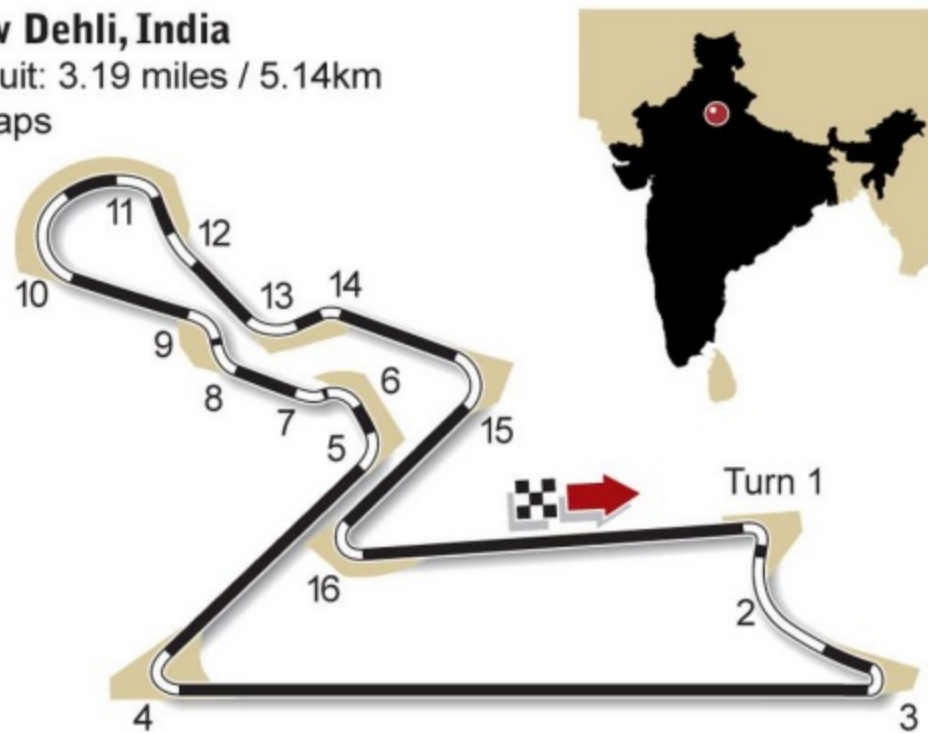
53 laps



## New Dehli, India

Circuit: 3.19 miles / 5.14km

60 laps





# RULES AND REGULATIONS

- Bodywork and Dimensions
- Stiffness
- Engines and KERS
- Impact and Roll Structure Testing
- Suspension and Steering system
- Weight

# GUIDING PRINCIPLES

- Safety of Drivers is Paramount
- Rules are encouraging for closer competition through resource restriction and technical regulations
- Ban on Driver's aids

# PERFORMANCE OF THE CARS

- Aerodynamics of the cars
- Engines and Engine electronics
- Mechanical Parts
- Tyres
- Cooling requirements



# EVOLUTION OF F1 CAR

## Ready for take off

What was, in the 1950's, still unknown territory, is today a guiding principle in race car development: well-researched aerodynamics and the required downforce are the top factors for success in Formula 1. The graphic illustrates the evolution of aerodynamics, from the 1950's to the current BMW WilliamsF1 (FW25).



High pressure: The Mercedes W196 Streamliner from 1954 typified the period's obsession with reducing aerodynamic drag.



Steep situation: one of the first race cars with a rear wing- the Matra MS 2 from 1968.



Absolutely liable: lowered side skirts introduced the "ground effect" era. The suction effect of the 1978's Lotus 78 produced enormous road grip, and high speeds.

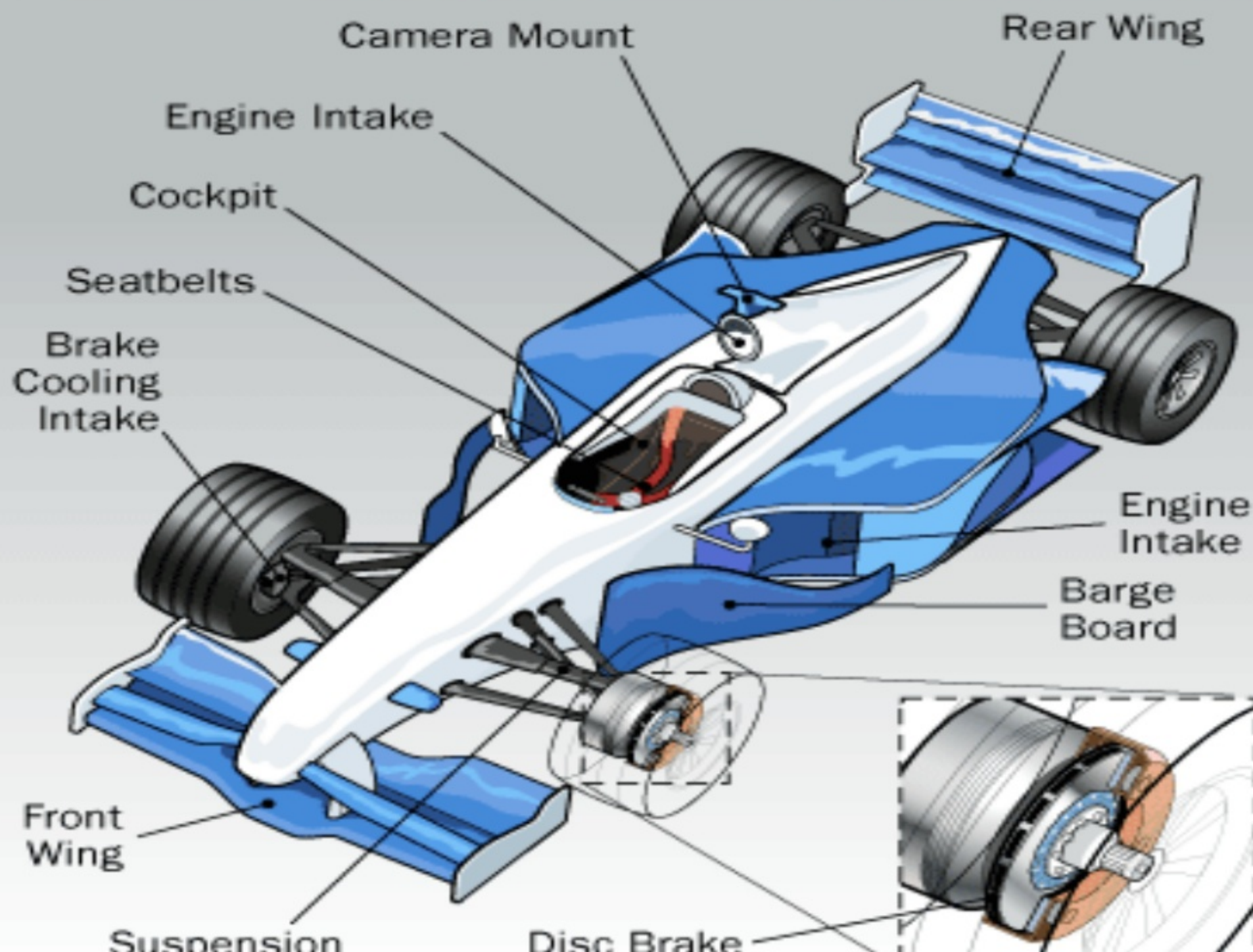


Certificate of achievement: the new BMW WilliamsF1 represents the current features of aerodynamics research - nearly every surface of the Formula 1 race car produces downforce.

Downforce ↓  
Lift ↑  
Airflow →  
Downforce-producing surfaces

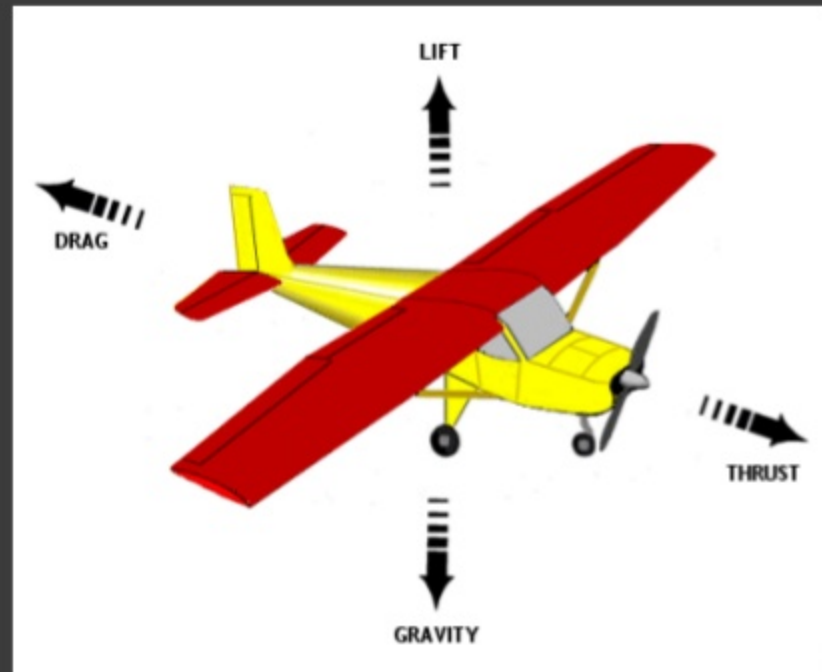


# How Formula One Works Car Basics



# BASIC AERODYNAMIC FORCES ON AEROPLANE

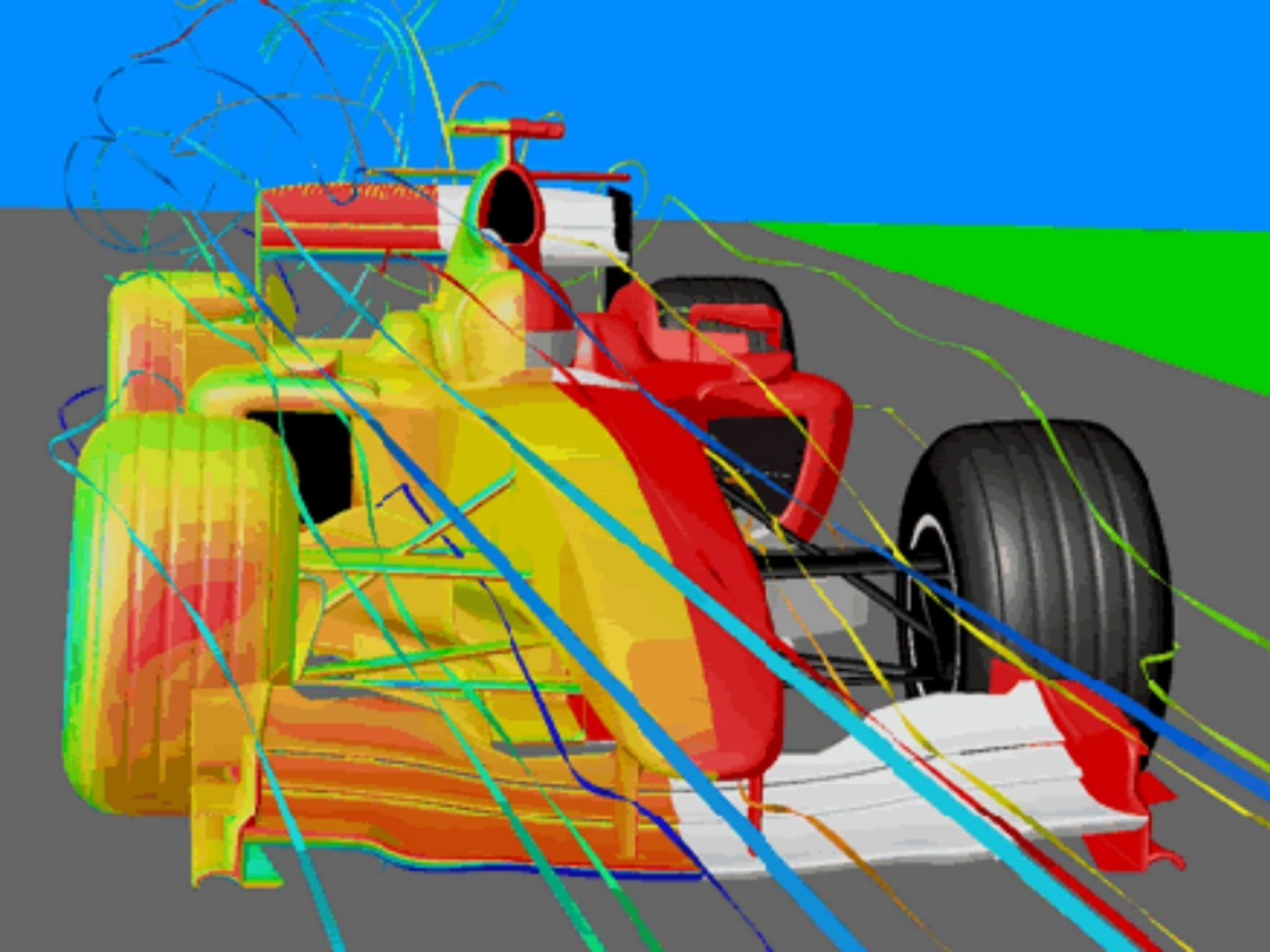
- WEIGHT
- DRAG
- THRUST
- LIFT



# AERODYNAMICS OF F1 CARS

- Increase downforce of the car
- Reduce the drag on the car and consequently improving top speed of the car
- Both are interrelated to each other





# CONCEPT OF DOWNFORCE

- Downforce describes the downward pressure created by the aerodynamic characteristic of a car.
- The principle that allows an aeroplane to rise off the ground by creating lift is used in reverse to apply force that presses the race car against the surface of the car. This effect is called aerodynamic grip.
- It can only be achieved at the cost of increased drag.



# Statistics for the Downforce

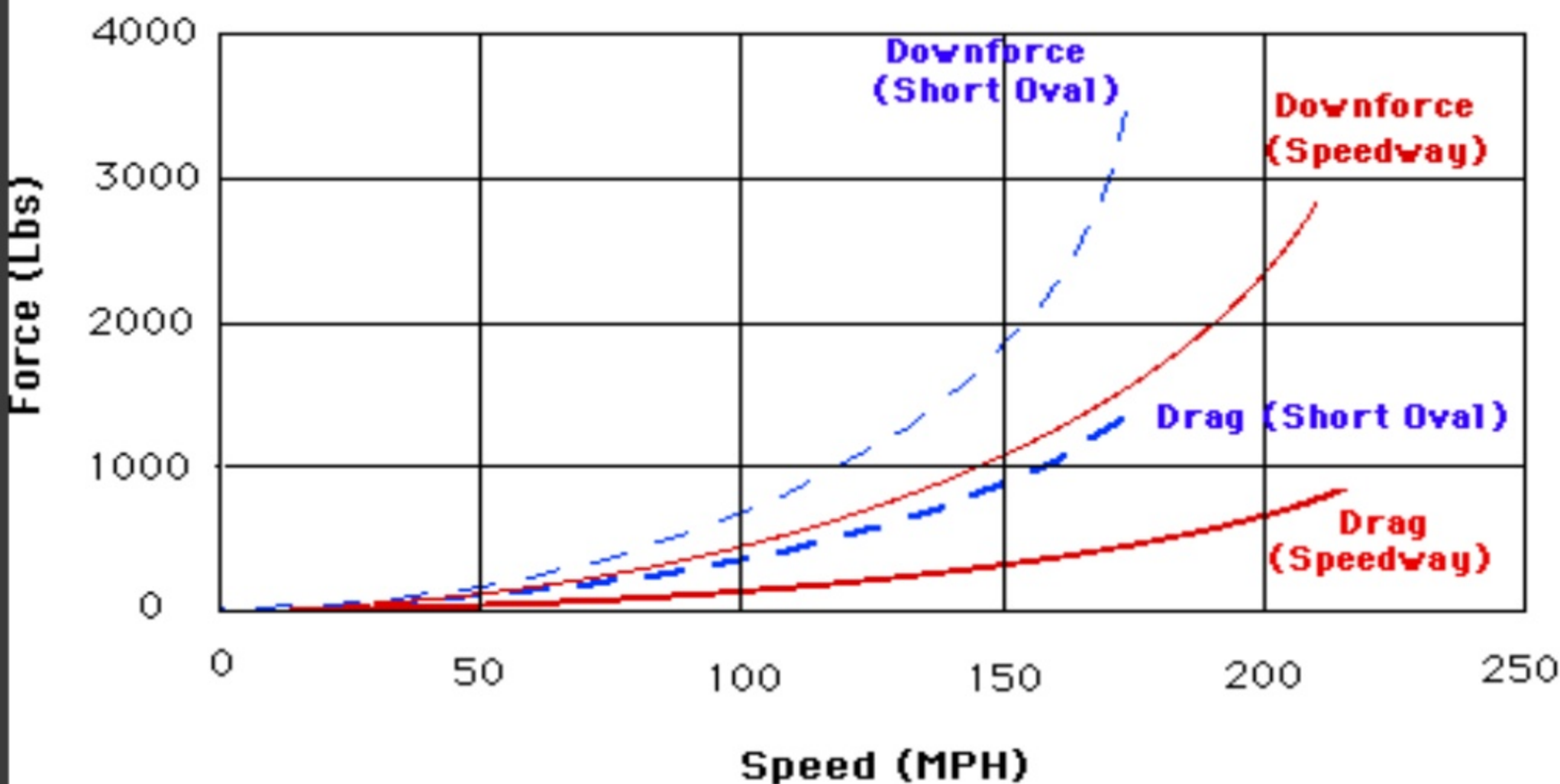
	Downforce (in lbs)	Drag (in lbs)	L/D	Cd	Speed For measurements (in mph)
Short Oval	3460	1310	2.64	1.397	165
Street circuits	3040	1070	2.84	1.141	165
Speedway	2835	972	2.92	0.669	220

# CALCULATING DOWNFORCE

$$D = \frac{1}{2} \times (WS \times H \times AoA) \times F \times \rho \times V^2$$

- D is Downforce in Newtons
- WS is Wingspan in Metres
- H is Height in Metres
- AoA is Angle of Attack
- F is Aerodynamic coefficient
- $\rho$  is Air density in kg/m<sup>3</sup>
- V is Velocity in m/s<sup>2</sup>

# Downforce and Drag Estimates of an Indy Car



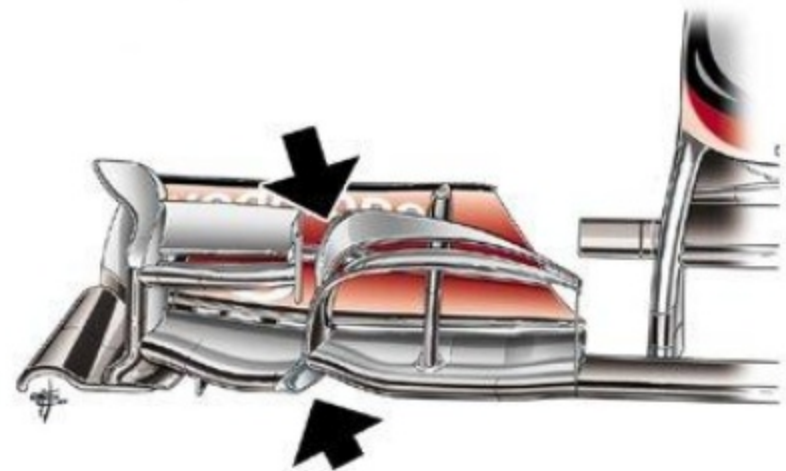
$$\text{Drag force} = K_1 \cdot V^2 \quad (V = \text{Velocity or Speed})$$

$$\text{Downforce} = K_2 \cdot V^2$$

# How the Downforce is generated???

## FRONT WINGS

- The shape of airfoils , including surface area, aspect ratio and cross section of the device.
- Larger Angle of attack creates more downforce
- Its End Plates reduce drag and also direct air over the front wheels
- Accounts approx. 33% of the downforce



# Contd...

## REAR WING

- Upper portion is a traditional multi-element airfoil with end plates.
- Lower portion pulls or drives air from the undertray
- Generates approximately 33% of the downforce.





# TYRES

- The only points of contact with track surface
- Acceleration and cornering very much depends on the tyres interaction
- Anti-thesis of optimal aerodynamics because they contribute significant drag

