

# Oliver Turner Past Poster

## 1805585

*by* Oliver Turner

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## Aerodynamic Advancement

**Oliver Turner**

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BEng Motorsport Engineering foundation year

### Introduction

Aerodynamics is a branch of dynamics that deals with the motion of air and other gaseous fluids and with the forces acting on bodies in motion relative to such fluids. (Merriam-webster.com, 2019)

What this means is that it is a way to analyze the way that a gas or liquid flows around the body of a vehicle, working out what affect said liquid or gas will have on the vehicle.

There are 3 main aerodynamic forces to take note of while racing (Competition-car-engineering.com, 2019)

**Lift** – The air lifts the vehicle, reducing grip.  
- Negative

**Drag** – The air pushes back on the vehicle, reducing speed and hindering acceleration.

**Downforce (Negative lift)** – The air pushes down on the vehicle, increasing grip.  
The main goals of an aerodynamicist are to reduce lift and drag whilst increasing downforce.

### 1968 - Wings

Graham Hill – Lotus 49B

For the first time, a formula 1 car arrived with a rear wing.

This would prove to be a huge breakthrough and would change formula 1 forever.

From this point, aerodynamic analysis would become a huge part of designing formula 1 cars

Wings work via Bernoulli's principle. The same as how an airplane wing works. The wing pulls itself into the low-pressure zone. The difference is that an airplane wing is the other way up so causes lift. A car wing causes negative lift (downforce).

**"Bernoulli Effect:** states that the pressure of a fluid (liquid or gas), decreases as the fluid (liquid or gas), flows faster."  
(Nas.nasa.gov, 2019)

### 1978 – Ground Effect

Colin Chapman – Lotus 79

Late 60s – early 70s,

Designers note the benefits of aerodynamic research.

A new breakthrough is made – ground effect.

"Ground effects turned the entire car into a large, inverted wing, using side skirts and underbody design to literally glue the car to the circuit." (Formula One Art & Genius, 2019)

It works by the addition of side skirts. These lock air under the car which is then propelled through two venturis (as shown in yellow). Bernoulli's principle then effectively glues the vehicle to the track.



F1 Aero advancements by:

<http://www.f1network.net/main/s107/st22394.htm>



Graham Hill's Lotus 49B

Courtesy of

<https://www.motorsport.com/f1/photos/graham-hill-lotus-49b-ford-11334221/11334221/>

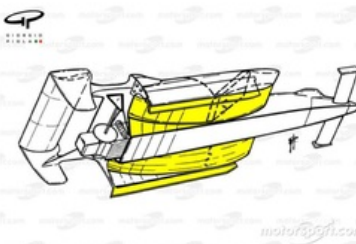


Image courtesy of

<https://www.motorsport.com/f1/news/retro-f1-tech-the-ground-effect-era-873918/873918/>



Modern Formula 1 car - Image courtesy of

<https://www.autosport.com/f1/news/141462/mercedes-reveals-its-w10-2019-f1-car>

### 1978 – Fan Car

Brabham BT46 – Niki Lauda

The same year as ground effects came another idea.

Literal suction.



Brabham fan car courtesy of:

<https://ca.motorsport.com/f1/photos/brabham-bt46-fan-car-6296603/20354637/>

Brabham found a loophole within the regulations that allowed them to build an extremely competitive car.

It goes like this:

“The reason why the fan was legal was a loophole in the fixed aerodynamic device regulations. This regulation stated that any aerodynamic device that PRIMARY'S FUNCTION was to affect the aerodynamics of the car had to be firmly fixed. On the BT46B, 55% of the fan's air went through the water radiator and 45% was used for suction.”  
(Auto123.com, 2019)

45% of the fan sucks air from under the car.

Skirts are used underneath to seal the car, much like a hovercraft.

A vacuum is formed, the car sticks to the track!

Unfortunately, this car wasn't liked by the other teams and it was voluntarily withdrawn by Bernie Ecclestone the same season. (Auto123.com, 2019)

### Modern Day -

#### A summary

Without these advancements, formula 1 would be very different.

Since these advancements, regulations have slowed cars down significantly forcing teams to be more imaginative.

Huge benefits have come in the form of fuel economy due to drag reduction techniques discovered by aerodynamic advancement.

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## GRADEMARK REPORT

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### FINAL GRADE

66/100

### GENERAL COMMENTS

#### Instructor

Good number of sources used and you have remembered to cite them within the text.

The similarity report is showing that the first sentence is copied from another source.

First impressions of the poster is that it feels a bit messy. I think that the arrows pointing from sections to photos is not helping. It would have been better visually to have put the photo for each section, either before or after the text.

The way in which you have presented the information could be improved. The poster could have more professional language used. In some sections you have got a gap between each section of information (Fan Car section) and in others it just all runs in together (Wings Section). It just feels that the poster is not consistently produced.

The F1 Aero Advancements image is good but it is too small to read the text.

The poster needs to be proof read.

**Historic Poster Mark = 66%**

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PAGE 1

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#### Comment 1

I would suggest putting the Lift in bold so that it stands out more. Same for Drag and Downforce.



#### Comment 2

Formula 1 should have a capital F.

## LITERATURE

Excellent  
70-84%

(including reading, referencing, academic conventions and academic honesty)

|                       |                                                                                                                                                                                                                                                                    |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OUTRIGHT FAIL 0-29%   | Little or no evidence of reading and/or reliance on inappropriate sources. Views and findings mostly unsupported and non-authoritative. Referencing conventions used incoherently or largely absent.                                                               |
| UNSATISFACTORY 30-39% | Poor engagement with essential reading. No evidence of wider reading. Reliance on inappropriate sources, and/or indiscriminate use of sources. Heavily reliant on information gained through class contact. Inconsistent and weak use of referencing.              |
| SATISFACTORY 40-49%   | Engagement with a limited range of mostly relevant and credible sources but with some reliance on information gained through class contact. Some omissions and minor errors. Referencing conventions evident though not always applied accurately or consistently. |
| GOOD 50-59%           | Engagement with an appropriate range of literature, including sources retrieved independently. Some over-reliance on texts rather than other sources. Referencing may show minor inaccuracies or inconsistencies.                                                  |
| VERY GOOD 60-69%      | Engagement with a wide range of literature, including sources retrieved independently. Selection of relevant and credible sources. Generally sound referencing, with no/very few inaccuracies or inconsistencies.                                                  |
| EXCELLENT 70-84%      | Engagement with an extensive range of relevant and credible literature. Consistently accurate application of referencing.                                                                                                                                          |
| EXCEPTIONAL 85-100%   | Exceptional engagement with an extensive range of relevant and credible literature. High-level referencing skills consistently applied.                                                                                                                            |

## K &amp; U SUBJECT

Excellent  
70-84%

Knowledge and Understanding of Subject. Extent of knowledge and understanding of concepts and underlying principles associated with the discipline.

|                       |                                                                                                                                                                             |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| OUTRIGHT FAIL 0-29%   | Major gaps in knowledge and understanding of the basic underlying concepts and principles of the subject matter. Inclusion of irrelevant material. Substantial inaccuracies |
| UNSATISFACTORY 30-39% | Gaps in knowledge of the basic underlying concepts and principles, with flawed or superficial understanding. Some significant inaccuracies and/or irrelevant material.      |
| SATISFACTORY 40-49%   | Limited knowledge and understanding of the basic underlying concepts and principles within the subject area. Some elements may be missing                                   |
| GOOD 50-59%           | Knowledge of the basic underlying concepts and principles is accurate with a good understanding of the field of study but lacks depth and/or breadth.                       |
| VERY GOOD 60-69%      | Competent knowledge of the basic underlying concepts and principles. Exhibits very good understanding                                                                       |

**EXCELLENT 70-84%** Excellent knowledge and understanding of the basic underlying concepts and principles of the subject.

**EXCEPTIONAL 85-100%** Exceptional, detailed knowledge and understanding of the basic underlying concepts and principles

## C&I SKILLS

**Very Good  
60-69%**

(Evaluate underlying concepts and principles of a subject and interpret qualitative and quantitative data in order to develop lines of argument and make sound judgements.)

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**OUTRIGHT FAIL 0-29%** Wholly or almost wholly descriptive work. Little or no evaluation of the underlying concepts and principles. Failure to develop arguments, leading to illogical or invalid judgements. Minimal or no use of evidence to back up views.

**UNSATISFACTORY 30-39%** Largely descriptive work, with superficial evaluation of the underlying concepts and principles. Weak interpretation of data, flawed development of arguments and judgements. Information accepted uncritically, uses generalised statements made with scant evidence and unsubstantiated opinions. Ideas sometimes illogical and contradictory

**SATISFACTORY 40-49%** Limited attempt at evaluation of the underlying concepts and principles, tending towards description. Can interpret qualitative and quantitative data but with some errors. Some evidence to support emerging arguments and judgements but these may be underdeveloped or with a little inconsistency / mis-interpretation.

**GOOD 50-59%** Good evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data, with minor errors. An emerging ability to use evidence to support the argument. Mostly valid arguments and logical judgements.

**VERY GOOD 60-69%** Sound evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data accurately. Ability to devise arguments using evidence to make mostly appropriate and valid judgements.

**EXCELLENT 70-84%** Excellent evaluation of the underlying concepts and principles. Can interpret qualitative and quantitative data accurately and with some insight. Excellent ability to devise arguments using evidence and make appropriate and valid judgements

**EXCEPTIONAL 85-100%** Exceptional evaluation of the underlying concepts and principles based evidence. Outstanding interpretation of qualitative and quantitative data. Exceptional ability to devise arguments using evidence and make wholly appropriate and valid judgements

## PROF PRAC

**Good 50-59%**

(Communicate the results of their study/work accurately and reliably, and with structured and coherent arguments; the qualities needed for employment requiring the exercise of some personal responsibility within a structured and managed environment.)

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**OUTRIGHT FAIL 0-29%** Work is poorly structured, disorganised, inaccurate and/or confusingly expressed. Very weak use of language and/or very inappropriate style. Failure to work effectively individual or as part of a group. Little or no evidence of the skills for employment requiring the exercise of some personal responsibility.

|                       |                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UNSATISFACTORY 30-39% | Work is poorly presented in a disjointed manner. It is loosely, and at times incoherently, structured, with information and ideas often poorly expressed. Weak use of language and/or inappropriate style. Flawed approach to individual or group work, meeting only partial obligations to others. Limited evidence of the skills for employment requiring the exercise of some personal responsibility.                   |
| SATISFACTORY 40-49%   | Mostly ordered presentation and structure in which relevant ideas / concepts are reasonably expressed. Work may lack coherence and/or accuracy in places. Can work as part of a group, meeting most obligations to others but perhaps with limited involvement in group activities. Demonstrates the basic skills for employment requiring the exercise of some personal responsibility, with some areas of minor weakness. |
| GOOD 50-59%           | Mostly coherent, organised and accurate work, in a suitable structure and is for the most part clearly expressed. Can work effectively independently and/or as part of a team, with clear contribution to group activities. Demonstrates the skills for employment requiring the exercise of some personal responsibility, with some areas of strength and some of minor weakness.                                          |
| VERY GOOD 60-69%      | Work is accurate, coherent, fluent, well-structured and organised. Can work effectively independently and/or as part of a team, with very good contribution to group activities. Demonstrates very good skills for employment requiring the exercise of some personal responsibility, with just occasional minor weakness.                                                                                                  |
| EXCELLENT 70-84%      | Work is coherent, very fluent and is presented professionally. Can work effectively independently and/or as part of a team, with an excellent contribution to group activities. Demonstrates excellent skills for employment requiring the exercise of some personal responsibility with an appetite for further development.                                                                                               |
| EXCEPTIONAL 85-100%   | Work is accurate, exceptionally coherent, very fluent and presented well. Can work effectively independently and/or as part of a team, with an exceptional contribution to group activities. Demonstrates exceptional skills for employment requiring the exercise of some personal responsibility with an appetite for further development.                                                                                |