



TEAM NOVA

RACE ALONG





DESIGN CONCEPT

WHAT MAKES A FAST CAR?

To understand the variables that affect the straight-line performance of an F1 car, we need to have an appreciation of physics, the forces that propel the car and the reactive forces that slow it down. We undertook an analysis of these forces to develop design concepts. We considered the following forces and the extent to which they could be controlled by our design:

- The thrust that propels the car forward, and where it is applied;
- The reactive drag force;
- Skin friction and rolling resistance

AERODYNAMICS

- Aerodynamics is the ways in which air moves around things.
- The rules of aerodynamics explains how the car is able to move.
- Anything that moves through air reacts through things.

FORCES OF AERODYNAMICS

- DRAG
- THRUST
- LIFT
- WEIGHT

DRAG

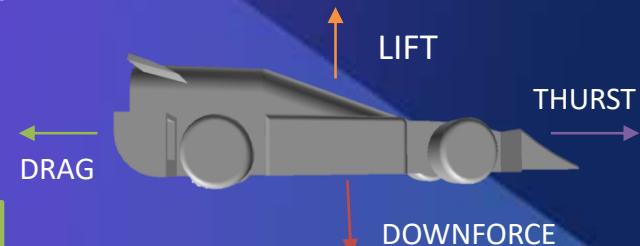
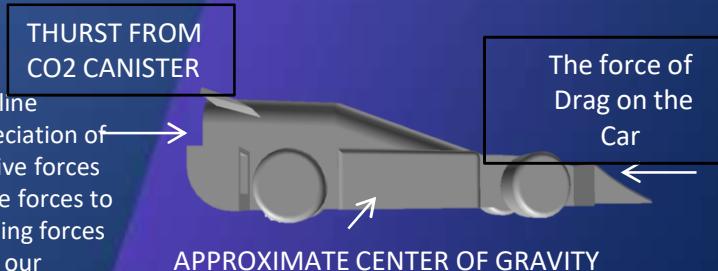
THE DRAG OPPOSES THE MOTION OF THE CAR.

DOWNGRAVE

THIS IS THE FORCE DUE TO GRAVITY THAT OPPOSES THE FORCE OF LIFT.

LIFT

THIS FORCE DIRECTLY OPPOSES THE WEIGHT OF THE CAR AND PUSHES THE CAR UPWARD.



THRUST

When a system accelerates mass in one direction, the accelerated mass will cause a force of equal magnitude but on the opposite direction.

SKIN FRICTION

Skin friction is a function of air density and the car's surface finish and 'wetted area'. Surface roughness was minimised by selecting a high quality paint finish and thin, smooth .Wetted area is minimised by its aerodynamics, its size, minimising changes in body shape and maximising the size of edge fillets.

ROLLING RESISTANCE

Rolling resistance is a function of the weight of the car, friction between the wheels and the track and bearing resistance. For the running surface of the wheels, we selected highly polished aluminium. Our wheels have been designed using polymer-steel bearings which are very efficient and have very low bearing resistance.

In addition, rolling resistance is increased by imperfections in the track that may cause the car to bounce and use energy from its forward motion. To minimise rolling resistance, suspension has been integrated into the wheel design to help absorb imperfections in the track and provide a smooth forward motion.



USE OF CAD/CAM. (CAD TO CAM PROCESS)

- ***What is CAM?***

The full form of CAM is Computer Aided Manufacturing. This is a software which is used to control design and other related ones in the manufacturing of work pieces. CAM may also refer to the use of computer to assist in all operations of manufacturing plant, including planning, management, transportation and storage. In simpler words- it is a software and computer controlled machinery to automate a manufacturing process.

- ***Based on this definition, one needs three components for a CAM system to function:***

1. **A Software**- that tells a machine about how to make a product (f1 in schools miniature car) by generating toolpaths.
2. **Machinery**- that can turn raw material into a finished product.
3. **Post Processing**- that converts toolpaths into a language which machines can understand.

- ***CAD to CAM Process:***

- CAD focuses on the design of a product or part. How it looks, how it functions. CAM focuses on how to make it. When a design is completed on the CAD software, it can then be imported to the CAD software. But while using FUSION 360, both CAD and CAM exist in the same world, so there's no import/export required. Once the CAD model is imported, both CAD and CAM exist in the same world, so there's no import/export required.
- QuickCAM Pro provides the link between your 3D design software and the Denford range of CNC Routers. It's a simple wizard-based CAM package which creates cutter paths from .STL files and image files for the machining of F1 in Schools cars or any 3D parts on a Denford CNC Router or Milling machine.



MANUFACTURING

- We had saved the car design in CAD file. Next, we had to send the design in and STL Format for the manufacturing purposes.
 - ***How does this manufacturing process work?***
- With all the different factors that influence the manufacturing process, it is very important to make sure that the block to the line correctly.
 - ***Wondering about the material used for this?***
- The material used for manufacturing the car is balsa wood. Balsa wood is used as it is a very light type of wood. Using a light-weighted material will make the car lighter in weight- thus, it results in increasing the speed of the car.
 - ***The process-***
- Firstly, we insert a piece to hold it in the back and then you've got the grip in the front wings.
- Then, the block is carefully (keeping in mind that it is lined carefully) kept over the machine which grips it over the pieces attached in the front and at the back.



RESTORATION PROCESS WITH A
WATERMARK EFFECT



RASTER ROUGHING PROCESS



CAR FOR
MANUFACTURING IN THE
MACHINE

- There are different cutting programs that are used.
- ❖ **Raster roughing process**- this process is used to cut off the majority of the material is removed. But this process had a *disadvantage*- it gives a very rough finish.
- ❖ **Restoration process with a watermark effect**- this process gives a lot smoother finish to the model.

COMPUTER AIDED ANALYSIS

- “Analysis is the art of creation through destruction.”
- *Computer-aided analysis (CAA) is the name given to the analysis and optimizing parts of the design process which, together with computer aided design and computer-integrated manufacture, form the complete design package. The benefits of integrating these approaches with computer aids are immense; they include decreased lead time, superior and efficient designs and reduced manufacturing costs. Computer-aided analysis is the name given to the analysis and optimizing parts of the design process which, together with computer aided design and computer-integrated manufacture, form the complete design package. The benefits of integrating these approaches with computer aids are immense; they include decreased lead time, superior and efficient designs and reduced costs.*

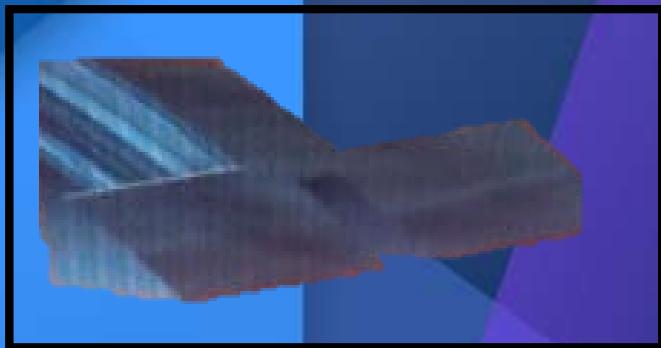


TESTING

- For the testing purposes we have used Autodesk FlowDesign Software.
-  | software is a 3D virtual wind tunnel for simulating air flow over and around our designs. It models airflow around design concept to help testing ideas early in the development cycle.
- Our drag was 0.43 at the first time. Not quiet impressed by the results, we decided to make improvement and changes. These changes included the change in the front nose and a little changes in the upper body.
- The next design lowered the drag to 0.39. There wasn't much fall in the drag, but still we didn't give up and continued doing the changes.
- And finally our third design gave us the drag of 0.32. We were all very happy with the results.



DESIGN CONCEPTS



ADVANTAGES

1. Looks
2. Aerodynamics
3. Drag



DISADVANTAGES

1. Thinness



1. Drag

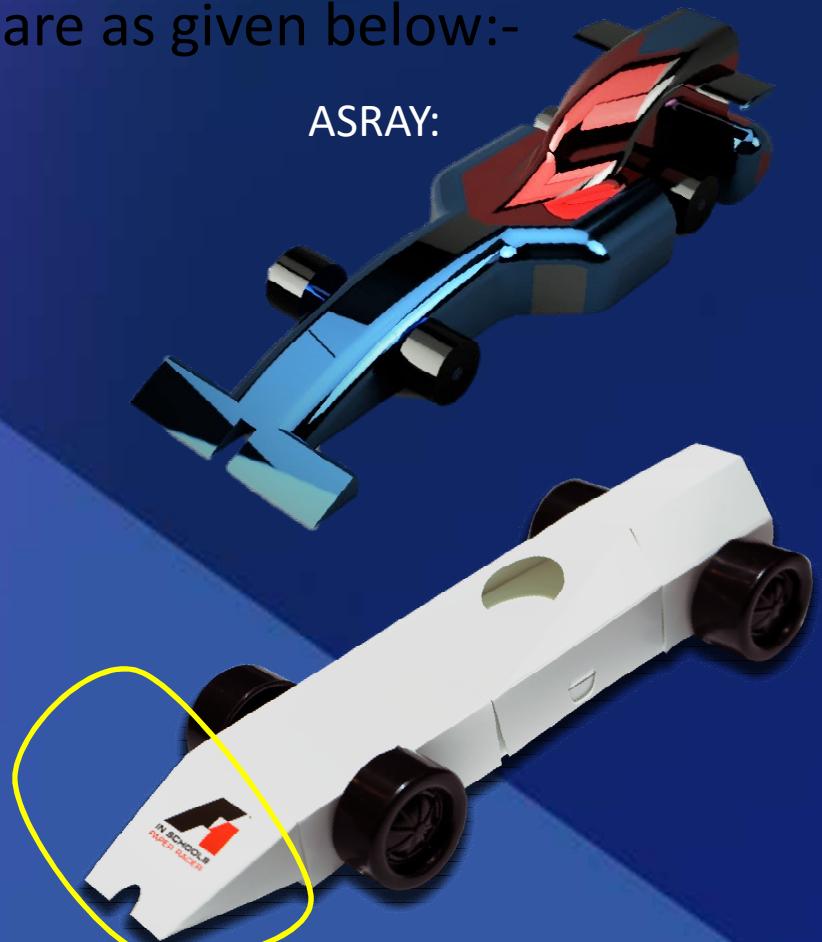
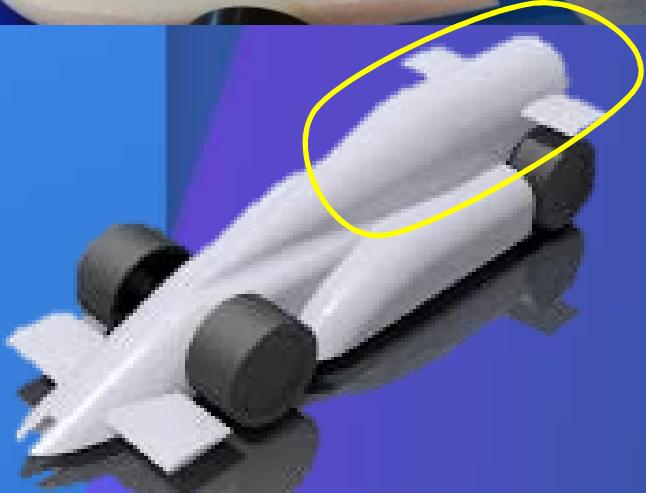
1. Aerodynamics

1. Looks
2. Drag
3. Durability



DESIGN EVOLUTION

- We took the references from Google and other websites. After seeing those references we visualized how our car would finally look like.
Some of the references are as given below:-





RENDERINGS

- Renderings are images intended to illustrate the three dimensional form of an object.
- These can be generated in isometric projection, oblique projection or perspective.





ORTHOGRAPHICAL IMAGES

