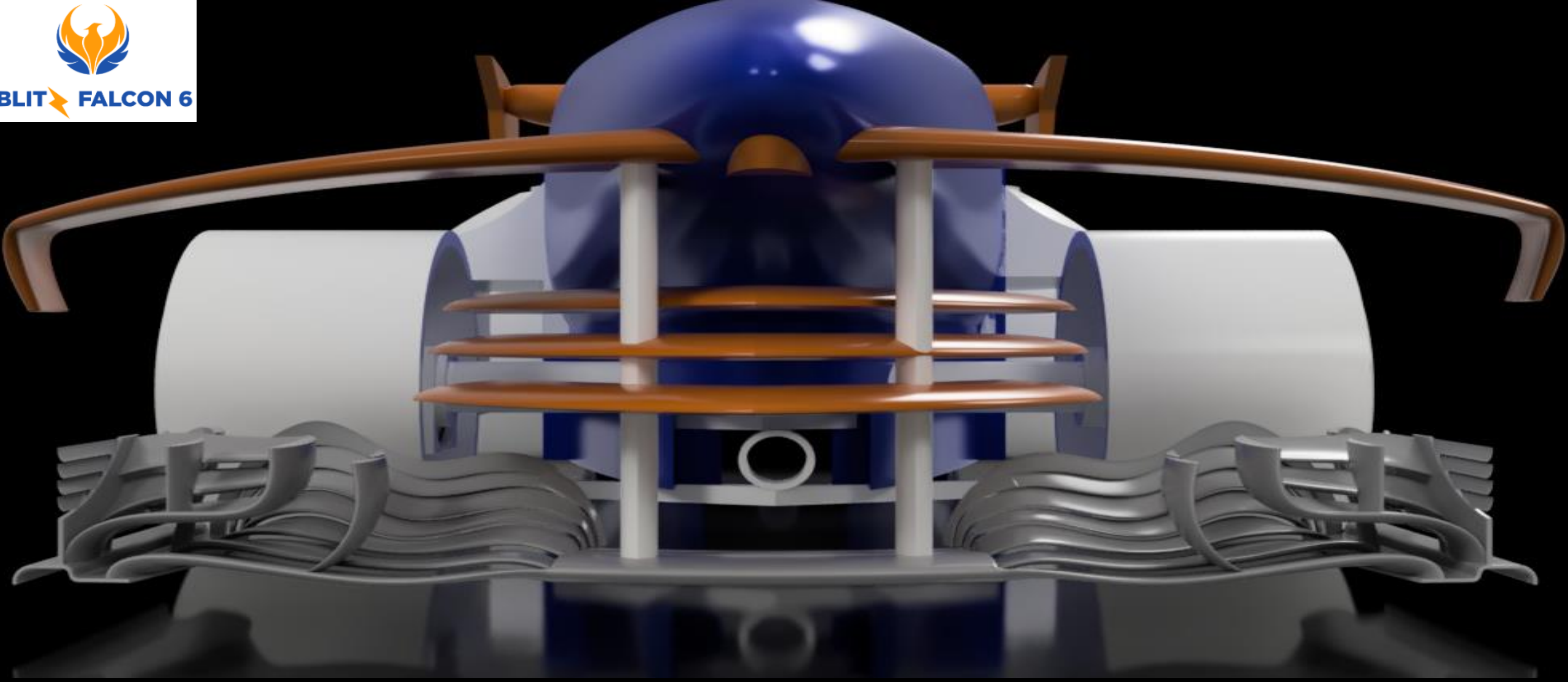


TEAM BLITZ FALCON 6 RACING

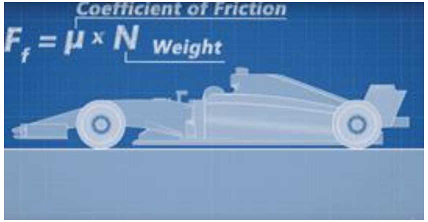
What makes a car fast?

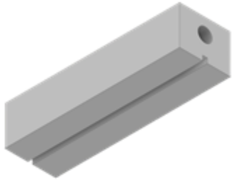
Before we began to design our car, we needed to learn the impact of various elements that would affect the speed and the design of the car, and these factors influenced the design language and the shape of the car. We used our research to produce a ‘design theory’ to aid us in the design and development of the car.

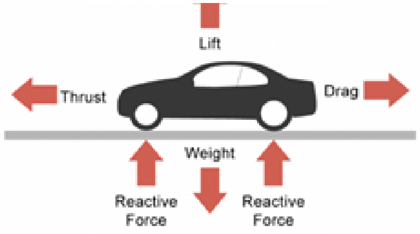
Aerodynamics: When it comes to speed, aerodynamic is known to be one of the major factors. It is an escalating tool for F1. The wings mounted at the front and rears of the car are responsible for controlling aerodynamics. The wings also allow air to pass through the over and under parts of the cars.

Chassis or framework: The framework is generally made of a special material block provided by the F1 in schools team. We had to take care of the F1 in schools regulations and carefully design our car around them. There is a certain minimum weight issued to the team, the wings and spoilers are made from 3D printed materials that help increase the sturdiness of the material and decrease the weight, for our car we used petG, it is a polyethylene terephthalate and due to the addition of glycol for extra durability and strength and has a density of 1.38g/cm^3, and decided it was the best fit after doing comprehensive research. You can find the details of the F1 in schools block in this link- https://www.f1inschools.com/equipment.html.

Thrust: Thrust is an extremely important part of car it is the heart of the car. It provides it with force that is responsible for acceleration of the car. Sometimes also known as fuel systems they play an extremely important role in any F1 car. Fuel system lies between the boundary of the framework and engine. Fuel system plays a significant role, as the main chore is to fetch the fuel form the tank. Then this fuel is supplied to the engine. . In the F1 in schools competition it is compulsory to use carbon dioxide that acts the main fuels supply for the car.







Friction: Also has to be taken into account as it is one of the key forces that reduces the speed of the car, moreover as the speed increases the friction also increases. In order to reduce friction we had to make sure that car’s wheel were made out of smooth material, allowing us to reduce friction. Furthermore, we needed to reduce the amount of friction in between the axle and the wheel for this we used custom manufactured bushes and used bearings.

The mathematical side: In any **F1** race both fluid and dynamic are calculated using mathematics., These numbers are changing all the time. Basic mathematical concepts are used to in order to calculate the fundamental variables of acting on the car. These mathematical concepts also help us influence the same variables aiding us in making the car faster rather than weighing down upon the car. Some of the basic formulas that we used were:-

- V= d/t- this was used to calculate the velocity of the car by dividing the distance covered(d) which was 25m and the time taken to complete the distance.
- V^2-U^2= 2as- This equation is used to calculate the acceleration of the car using velocity and distance, in this v-is the final velocity, u- is the initial velocity, s- is the distance and a-is the acceleration.
- F= uN - This was used to calculate the coefficient of friction on the wheels of the car , where F- is friction, u- coefficient of friction and N- the weight or force

Drag: This is the wind resistance (force) that acts against the F1 car as it is moving forward. Less drag means higher speeds, more drag means lower speeds. In a F1 car downforce is good because it is a force created through aerodynamics that pushes that car in a vertical direction towards the racetrack, but in this competition we are bound by tether to guide the car on the track and therefore downforce is not a priority. The equation used to calculate drag force is mg=12ρCAv2.

Design Theory

As we were going through our developmental process we started to question the influence of the previous listed variables on our car and how to control them? The ultimate question that came to our mind was how do we make it faster.

Variables influencing drag on a car-

Since this is one of the most active force that reduces the car's speed we needed to control it in order to gain the higher speeds than our regional championship car.

- **Air density:** This is a key variable that influences the drag on the car, the denser the air the higher the drag, but this was something out of our control as we would be racing the car's in fixed environment along with the rest of the teams.
- **Drag coefficient:** The drag coefficient of a car depends on the aerodynamic design of the car, in our designs we mimicked the design of the Ford GT, with it's bullet like aerodynamics and looks.
- **Weight:** This influences the drag as well as more weight means that more thrust needs to be used in order to reach the same speeds so we had to clear our undercarriage hollow out some useless parts of the car in order to make it lighter.
- **The Thrust:** This force influences the amount of force which is provided to the car during the start of the race, for all teams the same carbon-dioxide canisters were used providing unified thrust
- **Skin friction:** In order to make sure that we were able to eliminate any profile drag, we had to make sure that the air does not stick on the surface of the car and hence decreasing friction. For this we had to make sure that the front and the back wig wing were able to push out enough air to keep the airflow stable.

We also had to influence the **Aerodynamics** of the car in order to increase the speed and reduce the drag that the car was being subjected to during the races. For this we tried to model our front wing, spoiler and the main body of the car based on aerofoil shapes. This helped us in following Bernoulli's principle and keep the speed of car high.

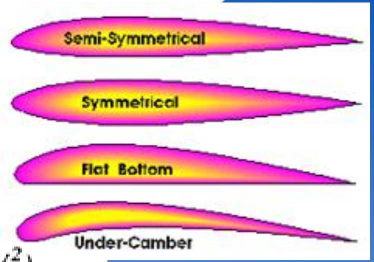
All our concepts followed basic design fundamentals that have been extracted form aerofoil aerofoil shapes. Our front wing and spoilers also resembled the shapes in order to improve aerodynamic flow and decrease drag. This was incremental to the design process as it helped in establishing the base of our design.

Semi Symmetrical: Semi-symmetrical aerofoils have some aerofoil shape on the bottom but a lot less than on the top. They use a little Bernoulli and a lot of Newton to develop lift lowering the downforce of the car, but in this race since we are bound by tether, more lift means that the air would be pushed above the car, creating a low pressure zone below and hence inducing more speed due to an increased newton force.

Symmetrical: This aerofoil can be used to increase speed drastically as they are able to provide a better attack angle increasing helping in reducing spin and keeping the car stable. Moreover, this was the aerofoil shape decided on the second concept car as it helped in increasing the aerodynamic flow rather than the semi-symmetrical (explained later).

Flat bottom: used for powered vehicles that are willing to make the compromise of having more drag in exchange for slower speeds or high lift capabilities. They do not penetrate the air well but can stay aloft at very low speeds. We did not use this aerofoil as it impacted our speeds severely.

Under Camber is used in vehicles with low power that need to gain lift, gliders use this aerofoil shape to gain lift and height. We did not use this in our design because we did not need to achieve high lifts.



$$P_1 - P_2 = \frac{1}{2}\rho(V_2^2 - V_1^2)$$

and $$A_1V_1 = A_2V_2$$

Therefore,

$$A_2 < A_1, \quad V_2 > V_1$$
$$V_2 > V_1, \quad P_2 < P_1$$

decreasing area = increasing velocity

increasing velocity = decreasing pressure

Research and Development

To conduct our research, we first had to identify the parts of our car that we were able to control and change. These would affect the overall performance of the car. We called these the ‘independent variables’ as they are independent from the conditions set by the F1 in schools management. The fixed variables that could not be controlled were the ‘dependent variables’. During our process we also realized that we needed to have fixed conditions that would affect the performance of the car, we called these ‘control variables’ as they needed to remain constant throughout our testing and development.

Dependent Variable:

- Speed of the car
- Drag coefficient of the car
- Aerodynamic flow(the car part being tested)
- Weight (material used only).

Independent Variable:

- Structural design of the car
- Aerodynamic design of the car
- Geometrical Design of the car
- Quality of manufacturing
- Materials Used
- Overall car weight
- Wheels designed
- Wheel support systems (bearings etc.)
- Final Assembly of the race car

Control Variables:

- The track used, has to be the same lane and same material
- Atmospheric Conditions (humidity, air density etc.)
- Starting Mechanism in this case the C02 canisters.

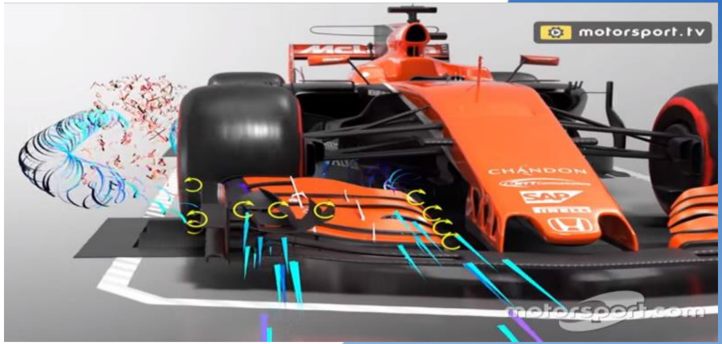
In order to make crucial decisions throughout the research process, we had to center our investigations on on the independent variables and their impact on each of the dependent variables. You can find more of information about our research through our design theory that contains the knowledge we obtained throughout the journey.

Wheel design: During our regional championship round, we found that our wheels were not able to run as smoothly as we had previously thought. As we went through our design once more we found out that even though we had implemented custom bushes. We realized that the wheels we had designed were extremely simple and heavy, making our car heavier. It also lacked a proper structural support system.

Bushes: For our regional championshop car we had made custom bushes, made out of copper. These were used to reduce the friction, and increase the speed of our wheels. We used the same bushes again as they were effective.

Bearings: We developed a simple bearing system. In this the bearing was attached to the wheel and the rotating part of the axle on one side and our suspension system on the other side.
We thought of using ceramic, stainless steel and polymer bearings but made a crucial decision to go with ceramic bearings, as they provide less friction because the materials being used are the same for both the ball bearings and the casing.

Front Wing: In addition to controlling the downforce, the front wings also control the total airflow around the Race Car. Being the first part of the car that the air comes in contact with, the front wing also governs the overall aerodynamics of the F1 car. Because it was incremental to design an efficient front wing to decrease overall drag of the car.



Research and Development

Design process: Like every other project, we also had to develop a design process that incorporated the different aspects required to develop our car. This was an extremely intricate plan as it was responsible to capture and test our ideas, to help segregate between ideas that were effective and which should be discarded.

For designing the cars we used a CAD (computer-aided-designing) software by Autodesk called Fusion 360. This software is a cloud based program that was able to decrease our render times as it was all carried out on the cloud. Moreover, the software provided us with the ability to store all our projects on the cloud and easily share it with the all the members of the team. We could also track changes made by each member and always be updated.

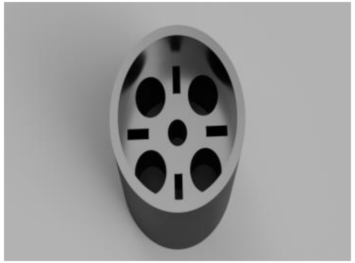
Since we already had a tried and tested car from our regional finals championship it acted as a baseline for all our test results and it also acted as a base on which we developed the design further. We had already learned that the airfoil shape of our front wings helped increasing speed and decided to continue developing it. Also from our previous car we were able to learn that a inverted quarter circle arc shape on the body and the side skirts was able to provide excellent aerodynamics.

Next, we individually developed and tweaked each part of the car in order test out new ideas that we had. Then the next step was to evaluate and test our designs on a Virtual Wind tunnel Software for this we used Autodesk flow Design and SimsCale.

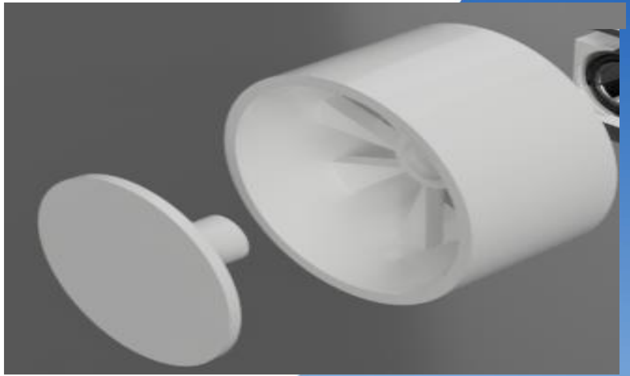
Due to individually identifying changing the elements we were able to observe the pressure acting on the car, the turbulence and the slipstreams that were being created around the car and on the car.

Once we identified several majors changes, we built them into our first concept car and through this we created our second concept car. Then we raced this car against the other car and analyzed the results obtained from the track and the virtual wind tunnel.
Through this process we were able to adapt several changes (mention number) onto our car and kept detailed records of each change we made on Fusion 360, through it's timeline process, this was easy to share with the team as they were notified of the changes made by each member of the team instantly.
Innovative Wheel Design: In order to make sure that our car had the least amount of friction possible, we created two individual wheel concepts and test them against our criteria. We also evaluated the impact of the wheels on the car body, including weight and friction.

Concept Wheel 1: This was a simple concept that involved the interior of the wheel to howled decreasing the weight of the car significantly. Another change that we did was to create an endoskeleton in the wheel which provided more structural integrity and allowed us to create a more stable wheel. Moreover, The outer structure of the wheel was thicker, and the material decided upon was Nylon as it is plastic with a high rate of absorption reducing disturbance on the car.



Concept Wheel 2 (final): Our second concept wheel was extremely different from the others as it involved an intricate systems that reduced both friction and weight. We carried forward the idea of exoskeleton from our first concept car but created a completely new design allowing for the same level of rigidity based on thinner yet more spread apart spokes. This allowed us to create a wheel with the least amount of weight.



Car Design and Development

Making Decisions

Collaboration is a crucial skill required by almost every team. It helps in making decisions and allows us to effectively take decisions for the benefit of the team. We produced 3 unique concept cars, and each car was better than the previous one, and contributing immensely towards our final car, which was a combination of all the unique elements of each car, we also improved upon our design from our regional final car.

Regional Finals Car- Was not able to spread airflow around the car effectively. Moreover, the car also had a huge drag coefficient.

Concept Car A- Aimed to decrease overall drag coefficient by reducing air and surface pressure throughout the car.

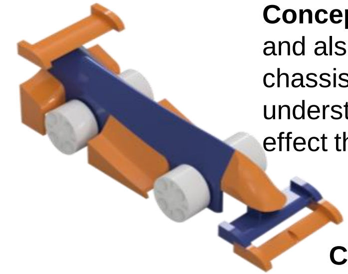
Concept Car B- Focuses on spreading the oncoming air around the wheels and the sides of the car reducing overall drag and surface pressure on the body of the car.

Concept Car C- Used A bullet like design to spread the heat around the main body and used a special design to divert the airflow above the wheels.

Criteria For Designing the Final Car

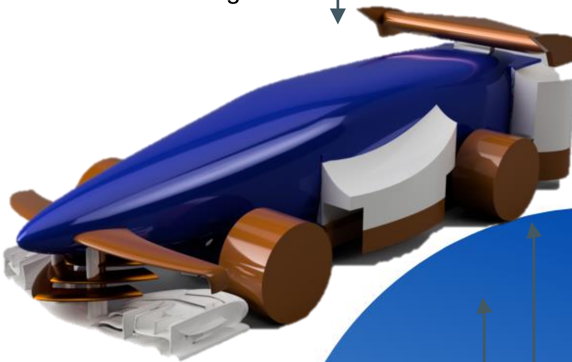
A rigorous process was used for designing the final car and involved the bellow mentioned criteria-

- Overall drag coefficient of the car tested using Autodesk Flow Design
- Ease of assembly and Manufacturing and based on CAM (Computer Aided Manufacturing) results using Inventor.
- Durability over multiple races.
- Overall Performance of the Car

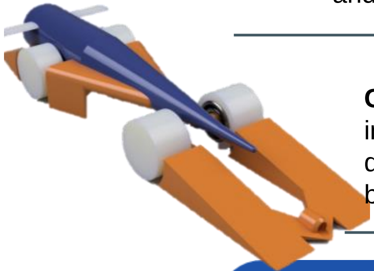


Concept Car A:This concept car improved upon on previous design and also brought the idea of decreased surface pressure along the chassis into the mix. By doing so it was able to help us better understand the aerodynamics of a car and how various changes can effect the overall performance.

Concept Car B:This car brought the idea of reducing underbody drag by creating special tether line guides that would help diver the airflow, it also used aero foil shapes to diver the airflow around and above the wheels to reduce drag. Since the wheel is spinning opposite to the airflow it is important to divert the airflow in order to reduce friction and overall increase speed.



Final Car: Peregrine V2



Concept Car C: This was one of our most unique designs as it involved the introduction of and entirely bullet shaped chassis into our design equation. It also introduced the concept of hollowing out the bottom of the car in order to reduce weight and also increase speed.

Car Design and Development

In order to make the manage and turn our ideas into reality we needed to develop an intricate design process that would be able to help us take note of all our change and keep track of components that had a positive effect on the car's performance.

First, we created a timeline which made it easier for us to organize our workflow. Then we used an app timely and added each and everyone of our members to a team. This app allowed us to assign tasks to each individual member, and upon the completion of the task all the members of Blitz Falcon 6 would be notified.

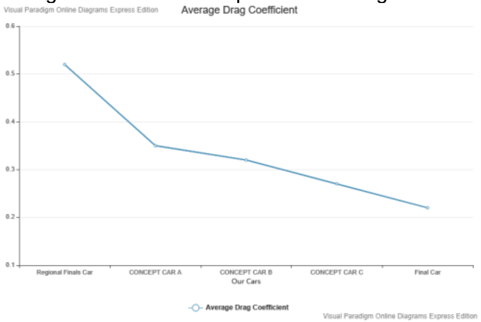
First, we conducted a detailed analysis of our regional finals car to find our mistakes and improve upon them. During this analysis we found out that the car had a lot of air and surface pressure, inducing more friction and slowing our car down significantly. We later started brainstorming and came up with ideas to tackle the problems with our previous car. We then came up with 3 individual concepts based off our regional final car.

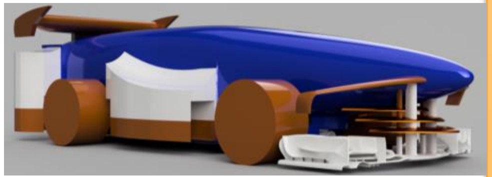
After this we analyzed the concept cars in great detail listing pros and cons of each concept car, by individually analyzing pieces of cars, and eventually the car as a whole. After completing this our team members all sat together and came up with a rough idea for our final car encapsulating the best features of each car.

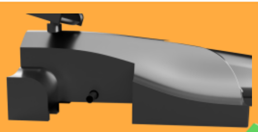
After remaking the main body, we decide to use parts of our previous designs such as front wing, back wing and side skirts to find out which best suited our car. This was an individual process with more than 10 different combinations and finally settled on the one with the least drag, and what we think would be fastest speed we could achieve.

Final Evaluation: Through our intricate design process we were able to identify, compare and contrast each individual part and changes. In the end we were able to build a car with changes that we could justify. Our final car had a drag coefficient of 0.22 (On the left is an example of our design process, which shows the evolution of parts and some example of design change).

The graph below showcases the average drag coefficient of all concept cars and our final car. We can clearly see the decreasing drag values. It also indicates a 57.69 decrease in drag coefficient as compared to our regional



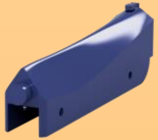




Our Regional Final Car designed specifically to throw air over the back wheel

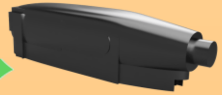
Concept Car B's fender 35% decrease drag coefficient

Final Car's side skirts Decrease another 30% drag coefficient as compared to B



Original Chassis, same as the one used in concept car A

Concept Car C's chassis 15% reduction in drag coefficient.

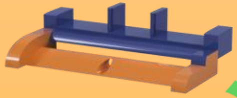


Final Car's Chassis another 25% reduction in drag coefficient

Concept Car A 4% Reduction in Drag Coefficient as compared to regional finals

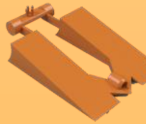
Our final Car's Rear Wing 300% decrease in comparison to Concept A

Concept Car C's Front Wing, 40% increase in drag as compared to final car.



Concept Car A's Front Wing, 10% reduction in drag as compared to regional finals car.

Final Car's front wing, adapted from Concept B, 80% reduction in drag compared to concept A.



Concept Car C's Front Wing, 30% Increase in drag force as compared to final car.

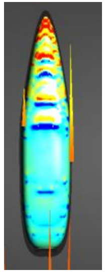
Aerodynamics

In race engineering, aerodynamics is one of the most important factors that impact the performance of a car on the track. So it was extremely important for us to design the car keeping aerodynamics in mind. It provided us a chance to innovate and improve our design.

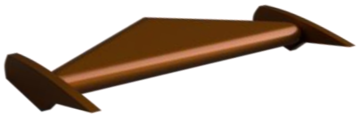
Side skirts: Front and Rear side skirts of a car are extremely important when it comes to optimizing airflow. During our research we and testing we found out that using a teardrop design is extremely effective, therefore we innovatively redesigned the side skirts by making them circular and therefore diverting the airflow around the tires.

Tether Line Support: This may come as a surprise, but the tether line support is placed underneath the car. When air gets stuck underneath a car, it induces drag and makes the car slower. So we put two triangular fins above and below the car that allowed air to move swiftly underneath the car and reduce overall drag. This impacted the car's performance by about 6% increase in speed.

Chassis: While redesigning our chassis and main car body we looked towards the sky, where the most aerodynamic vehicles can be found; Rockets. The main body of both these vehicles is designed to penetrate air at high speeds. So we created a car body inspired from the rocket. The body had the lowest drag coefficient we had seen 0.15.

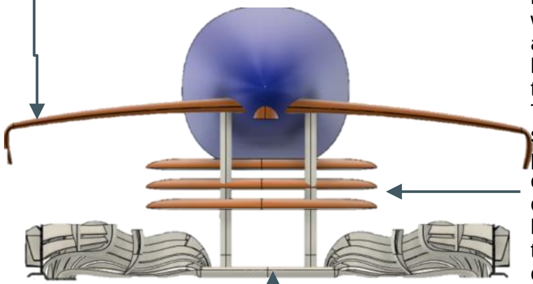


Rear Wing: Our rear wing was designed to increase the downforce of our car. We took inspiration from one of fastest car the Konessing Jesko. The wing was able to reduce pressure from our car and improve aerodynamic flow while increasing downforce.



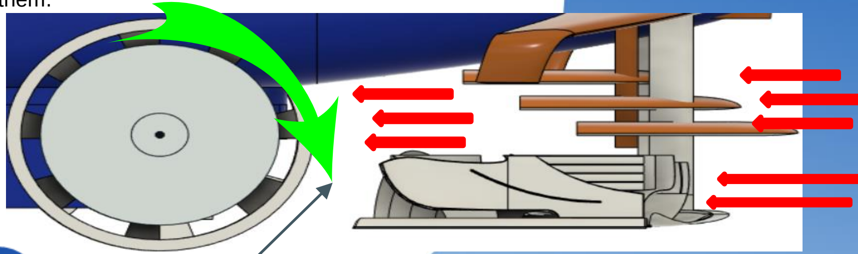
Nose Cone: The nose cone is one of the most important part of a race car as it is the first part of the car that comes in contact with oncoming air. It is important to design the nose cone so that it diverts the air around the car optimally. The Front Wing is divided into 3 parts and each are designed to carry out specific functions.

Top Wing: Specifically designed to streamline oncoming air and helps reduce drag by diverting airflow above and around the wheels by creating outwind. It also provides downforce that would help the car to remain stable while racing. As you can see in the photo from the virtual wind tunnel situation, the nose cone has a tremendous amount of pressure, this part is also designed to ease surface pressure on the nose cone by dividing the pressure along the surface area.



Mid Wing Splitter: The mid wing is made to split the air around the car. Since there is a lot of empty space between the top wing and the bottom wing. The mid wing consists of 3 splitters located in a stair pattern. This has a huge impact on airflow. Also since the bottom of the car consists of the tether line support and a body to hold the axles it was important to create this wing in order to follow the design curve of the car and not increase drag.

Bottom Wing : The bottom wing is inspired from the front wing of a F1 car, it is designed to improve airflow and also improve downforce. Moreover since the oncoming flow of air is in the opposite direction of the car it is important to divert airflow away from them.



Direction of Wheel Spin

Direction of Oncoming Air

Testing

Testing is an incremental part of any development process. In order to make sure our car performs well, and to make sure that is was durable and strong enough to handle extended periods of racing.

Our Car testing was divided into three-part, Virtual Testing, Theoretical Testing, and Physical Testing. But due to the pandemic we were unable to conduct physical testing and therefore only our plan has been mentioned in this portfolio.

Theoretical Testing: This including basic calculations like the amount of force produced by the C02 cannister. Since we knew the velocity of our regional finals car by using v=d/t and knew 2 of three variables (distance=25m, time=1.45 seconds) the velocity we got was 34.48 m/s.

We then calculated the acceleration using s=ut+1/2at^2, where (s) is the distance travelled by the object (u) is the initial velocity, acceleration is represented by (a) and (t) is the time taken. We found out the acceleration 23 m/s*s. From this we used the formula F=MA, derived from newtons second law of motion to calculate the force provided by the cannister (with the mass being 78gms) which is approximately 1.853N on average. So for further calculations we used 2N after factoring in drag.

We then calculated the acceleration of the new car based on the projected mass 50gms, using newtons second law of motion and got an average acceleration of 40 m/s*s(a 70% increase due to less weight). The next step was to find the average time, using s=ut+1/2at^2, we came with an average time of 1.11803 seconds on a 25m track, a projected 10% decrease. If we include a drag force of 0.449.

Physical Testing (Planned Not Conducted): Our physical testing was to be divided in to three detailed tests in order to decide our final car.

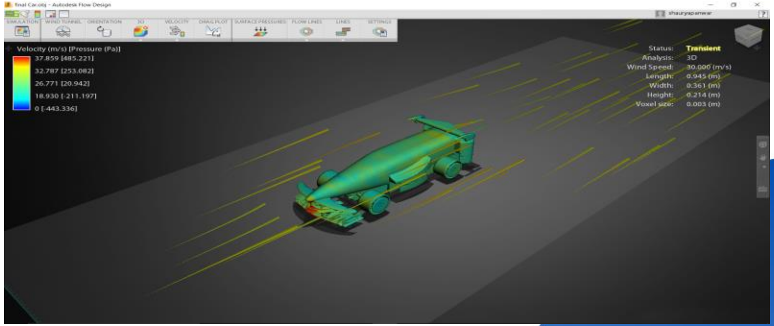
1. **Speed Testing of Concept Cars and Final Car on Track.** In this we aimed to see the real-life performance of our concept cars and compare them to our final car and then decide on which we would use for our national finals. We would race each car 3 times, and then calculate the average. The fastest car would win.

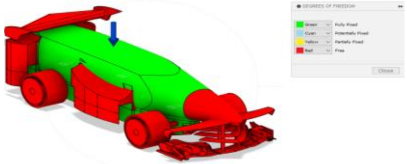
2. **Endurance Test of Final Car on Track.** In this test we would take our final car and race it along the track at least 25 times and the we would do a detailed analysis of the car and take note of the damage sustained by the car and then strengthen those area.

3. **Wind Tunnel Testing.** We wanted to create a wind tunnel and test our concept cars and our final car to get a clean view of the airflow. In this we would have taken a fan and attached it to transparent tube big enough to fir our car. We would the attach a smoke machine to the end with the fan and observe the airflow of the car.

Virtual Testing- Since our planned physical testing got cancelled due to the COVID-19 pandemic, we had to conduct virtual tests that would allow us to replicate our physical tests. For this we used multiple simulation software such as SIMSCALE, Fusion360 and Autodesk Flow Design.

Virtual Wind Tunnel Testing: Since we were unable to build our Wind Tunnel due to the nationwide lockdown and also not manufacture our cars, we needed to run a virtually simulated wind tunnel using Autodesk Flow Design, which gave us a average drag coefficient. This test was used to finalize the car, as we selected the car with the least drag coefficient. Our final Car had a drag coefficient of 0.22. Flow Design also showed us the varying surface pressure on the car and gave us the opportunity to see the airflow and improve upon our designs.





Impact Velocity testing: Since our car had to be stopped on the racetrack using a blanket or a support structure, we needed to find out how much impact force our car can handle. For this we used SIMSCALE an online sim software. The results showed that our car would easily handle 60m/s of impact velocity on blanket, making it ready for races

Static Stress Testing: In order to find out how durable our car was we needed to run simulations that would provide us with accurate results. For this we used FUSION360 since it has an easy to use static stress test study. We found out that our car would easy handle 20N of force without taking any sort of damage. This simulation also showed us where our car was weakest as well.

Manufacturing

CNC Machining

CNC machining is a manufacturing process in which pre-programmed computer software dictates the movement of factory tools and machinery. The process can be used to control a range of complex machinery, from grinders and lathes to mills and routers.CNC offers the ultimate in flexibility, high quality, and reliable machining services. Exotic materials and close tolerance parts are efficiently manufactured and delivered promptly, in both large and small production lots.

Since we are using a CNC machine, it was important to simulate the machining process and drill bit part using a Computer Assisted Manufacturing Software. For this we used Autodesk Inventor as it has a simple to use and accurate software.

Steps for CAM simulation-

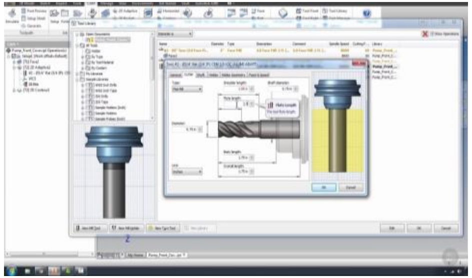
1.First select operation type form an option of Milling, Cutting or Turning. For us it was turning.

2.Then we need to set the orientation of the axes by picking a face or an edge on the model.

3.After this, we need to select the origin axes or the point where zero will be located.

4.Define the stock size and shape of the material that needs to be cut.

5.After this we simulate the drill bit's path so that it can be used to manufacture the car.

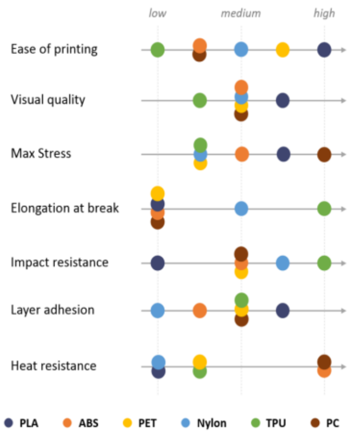


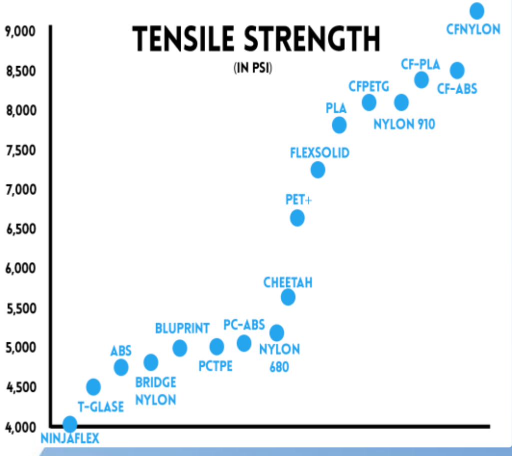
3D printing

We had to use a 3D printer to manufacture the front and rear wings of the car along with wheels. The material we decided to use was Nylon, as it has a low density meaning less weight and higher tensile strength. They were designed in a CAD software and converted into an STL file that could be understood by the machine. For our 3D our parts we used a FDM process as it is very precise and can print very detailed parts. Fused filament fabrication, also known under term fused deposition modeling or FDM, sometimes also called filament freeform fabrication, is a 3D printing process that uses a continuous filament of a thermoplastic material After this we used the most important step was to select the orientation of the parts that would be the most efficient. The next step was to give the components a light sanding the car.

Material Properties

While manufacturing our car it was important for us to decide what filament would be used to print the parts for the car. We decided to use Nylon. Nylon is a generic designation for a family of synthetic polymers, based on aliphatic or semi-aromatic polyamides. It has high impact resistance and tensile strength making it suitable to use in our car as it can withstand the force around 8000 PSI (For more information refer to the charts below). It also has a very low destiny of around 1.15 g/cm³, making it a very light material and considering the other properties of the material Nylon was the perfect material for our car.





Finishing Touches

Smoothening

It is fundamental for a car to have a smooth finish not only for the aesthetics but also for the aerodynamics. Therefore it was crucial for us to have a smooth surface to even out the printing threads on the Nylon parts of the car and to smoothen out imperfections instilled by the CNC machine. We used to have sanding to smoothen out the surface of our car. We used P400 and P600 grit sandpaper respectively to smoothen out the main body. We used these specific grits because they are the least abrasive and most suitable for the main body. For the 3-D printed Nylon parts, there were few hard printing deformities, which were fixed by using P80 followed by P220 and P400 sandpaper to first remove all the extra threads from the parts followed by smoothening all scratches caused by the P80 sandpaper. Finally, softening the surface the surface with the P400 sandpaper.

Paint

To begin with, painting is not just a tool of aesthetics but also the dynamics of the car. A good paintjob can allow us to improve the smoothness of the car surface which enables the car have a more efficient airflow. For our paintjob we took help from our kind sponsor (Deepika Exports) where they guided us on the techniques of Spray Painting. The company's expert painting professional displayed the process of painting, including the use of various nozzles to improve overall aesthetics and achieve a clean paintjob. We first applied a single coat of white paint. So that the surface is not visible under the livery. The second and third coats of paint were the signature colours of our team Blue, Orange and White for the respective parts according to our car design. This resulted in creating the basic aesthetic of our car. Followed by the painting, we stuck our sponsorship logos and the F1 in school's logos on a custom 4mm sticker. Now this interrupted the car’s smooth surface which was the healed by the even spreading of a custom primer coat, using flat, broad, sharp and soft industrial brushes.

Wheels

Tires in F1 play a crucial role in improve the pace of the car. Similarly we tried to adapt the concept and further innovated on it. The idea was to print a wheel with least amount of friction for which we used PTFE as it has the lowest coefficient of friction. We printed the wheel with and extra margin of 2mm which was then sanded out to smoothen the surface even further to reduce friction. The sanding process incorporated the use of a custom setup for rotating the wheel using a custom holder made out of wood which ensured the safety of the wheel at the same time was compatible with a cordless hand drill. The wheel was spun against the stationary sandpaper of grit P400 followed by P600(wet).