



# Team Neidín

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5 Page Proposal

Conor Casey, Emmet Glynn  
Johnston, and Asher Grant

# Team Structure

## Team Members

### Conor Casey: Team and Finance Manager



Conor has worked on a plethora of projects in the past, from competing in the BYSTE to the Vex Robotics Competition, and he has done so in a leadership capacity. As such, he was deemed as having a high degree of experience in leadership, and hence, why he was chosen as team manager. He has a deep passion for mathematics, precision and rigorousness, and as such, was picked as the most suitable candidate for the position of finance manager. In his role as team manager, Conor takes responsibility for the management of the team, defines team goals, objectives and aims, ensuring the cars are adequately prepared for the competition and defines a timeline that the team must follow to ensure everything is ready for competition day. He is also accountable for the organisation of the team's financial resources through the upkeep of an orderly budget; which records the predicted and actual expenses and income generated, and appropriately allocating funds to certain areas of the project.

### Emmet Glynn Johnston: Design and Manufacturing Engineer



Emmet has always had a strong passion for engineering and design. He has a great interest in taking on metalworking projects at home that involve problem solving and creativity. His strengths in technical drawing as well as metalwork, suited him well to the role of designing and manufacturing a vehicle to compete with. Emmet in his role as design engineer oversees the creation, design, styling, and performance of the car. Similarly, in his duties as manufacturing engineer, he will advise the wider team with respect to the manufacturing requirements of the car.

### Asher Grant: Marketing Manager and Graphic Designer



Asher has a passion for car aesthetics and engineering design. His strengths in sociability and technology are suitable for the task of managing online social media and talking to the general public. His aptitude in art makes him ideal for the role of graphic designer. In this position, Asher supervises the creation of the aesthetics of the car. This will be done in close collaboration with the design engineer to ensure that such aesthetics may not negatively impact the performance of the car. In his duties as marketing manager, he will create any necessary marketing materials required for the promotion of the team and undertake any related public relations tasks which align with the goals of the team.

## Intra Team Communication

Due to the COVID-19 pandemic and the resulting inability of regular in-person team meetings to take place, a detailed and comprehensive intra-team online communication plan was needed to ensure functioning and effective team collaboration. Microsoft Teams was chosen as the primary method of team communication online. Email will also be maintained as a means of communication throughout the duration of this project.

## Time Management

Time management is critical for the successful and timely completion of any given project. This is especially true in our case, as Conor and Emmet are currently in examination years (Leaving Certificate and Junior Certificate respectively). Hence, to avoid any unnecessary stress, a timeline was created by the team. A degree of flexibility was incorporated into the schedule as unforeseen events and circumstances may occur which may inhibit the progression of the project.

Conor will ensure the team is closely following the outlined timeline, and hitting the key milestones as originally envisioned as much as possible. In line with this objective, he will stay in regular communication with each team member. A shared calendar on Microsoft Office 365 has also been created, so, each team member knows the deadlines they must hit to complete this project in a timely and orderly fashion.

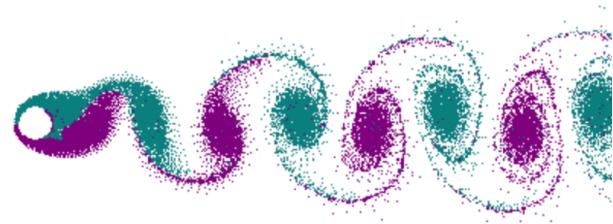


# Research

## Key Concepts

- **Drag** is the force that pushes against a physical moving body, to oppose its velocity. We will need to ensure all surfaces have a smooth finish to minimize drag and allow the vehicle to continue in motion once the CO<sub>2</sub> cylinder has been expended.
- **Lift and downforce** are bifactors of drag that can be used to our advantage. Lift and downforce are both forces experienced normal to the plane that the body moves in or along. Too much lift could cause the car's wheels to lose contact with the track, while too much downforce causes unnecessary friction.
- **Reynolds number** helps predict flow patterns in different fluid flow situations. At low Reynolds numbers, flow tends to be dominated by laminar flow, while at high Reynolds numbers flow tends to be turbulent.
- The Reynolds number is defined mathematically as follows:

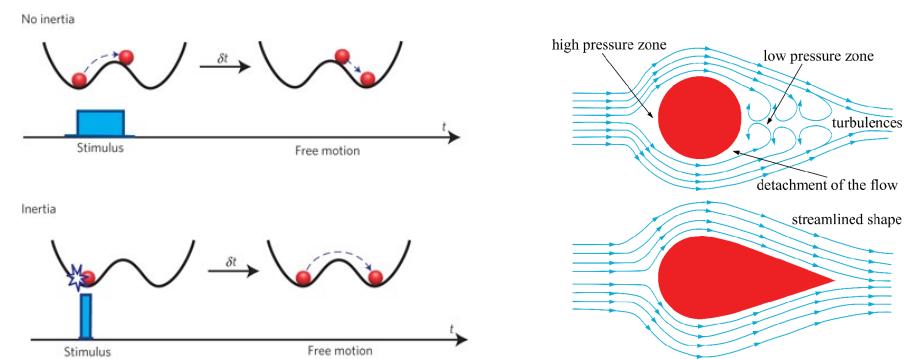
$$R_e = \frac{\rho u L}{\mu}$$



- **Skin Friction** is the drag caused by how air flows over the surface of an object. Once laminar flow turns turbulent, drag increases dramatically. Suitable surface finishing is vital in keeping skin friction to a minimum. This will require us to sand every component completely smooth, after it has been machined and apply a finishing coat of paint.
- **Pressure drag** is caused by the air particles being more compressed on the front-facing surfaces and more spaced out on the back surfaces. This is caused when the layers of air separate away from the surface and begin to swirl - this is called turbulent flow.

- Newton's first law states that if a body is in motion, it remains in motion unless a force acts upon it. This is **inertia**. The forces that will affect our car's velocity are drag and friction.
- **The drag coefficient** will allow us to mathematically compare the aerodynamics of all vehicles that we design. It gives a numerical value that can aerodynamically compare and rate any physical body relative to their frontal surface area and the density of the fluid in which they move through.
- The drag coefficient is defined mathematically as follows:

$$C_d = \frac{2F_d}{\rho u^2 A}$$



## Applications

- **Wings** are used to manipulate the drag caused by air travelling over them, we will need to balance maintaining contact with the track, with the ability for the CO<sub>2</sub> cylinder to propel the minimum weight possible without sacrificing velocity.
- **Nose Cone** is used on the front of the car to create a slip stream of air around the rest of the body. We face the dilemma of utilising a short round cone, which reduces the car's overall length; or a long pointed one, like the front of the fuselage of a fighter jet.
- Using **wheels** that have the least amount of track contact will result in minimal friction with the ground, and hence, reduce the forces opposing the car's velocity.

# Design

## Concepts

### Concept A



The initial design for this project, which attempted to incorporate the key concepts researched into an efficient and aerodynamics design.

#### Features:

- The conically shaped body, which houses the CO<sub>2</sub> cartridge, tapers downwards into a point. This optimizes airflow around the body and improve the aerodynamic efficiency of the vehicle

### Concept B



This design focuses on a longer, and lower car design, with an increased emphasis on airflow.

#### Features:

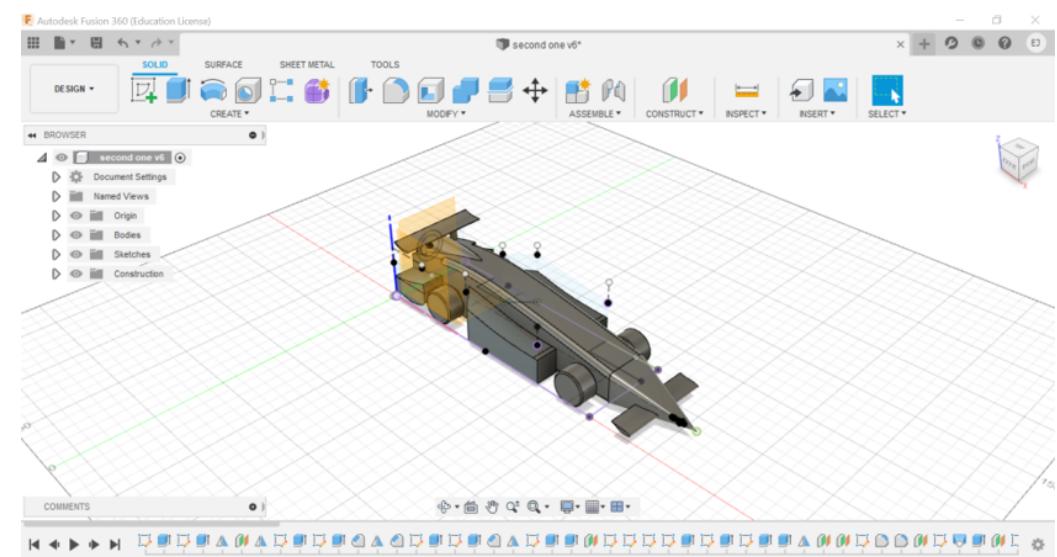
- This car will incorporate centre a low centre of gravity. A lower centre of gravity should increase the car's stability at high velocities.
- The sidepods present on the vehicle will allow much of the air to smoothly flow over the wheels. This will result in a decrease in the Reynolds number.

## Problems Overcame

- The CO<sub>2</sub> cartridge was going to clash with the rear axle, so to solve this we decide to extrude a cylindrical form back into the end of the body to encapsulate the cartridge. Because of this, two rear wing supports had to be placed on either side of the extrusion to

## Software

All design concepts have been produced using Autodesk Fusion 360. We are considering a migration to SolidWorks, as our school has access to the education licence. The software incorporates computational fluid dynamics (CFD).



## Prototyping

We have access to a 3D printer which we will use to print prototypes early in the design phase. We will test these for visual appearances, as well as their aerodynamic efficiency using a smoke tunnel. We will also be using CFD software to test the efficiency of the individual components of the vehicle, such as wings, to further enhance their efficiency by evaluating the drag coefficient and the Reynold number of the various designs.

## Evaluation

Producing design concepts initially proved challenging. With little experience with CAD and very little time to learn, we feel we have made significant progress in the limited time frame. The design concepts, which we have developed, will be the starting point for our innovative car design that we hope to produce over the course of the next two months.

# Project Management, Sponsorship, and Budgeting

## Contingency Planning

A contingency plan, or “Plan B”, is necessary in the unfortunate event that the main timeline and plan doesn’t unfold as expected. Contingency planning is done when it is apparent that there is potential risks that exist which can sideline the project. Without having a plan in place, the chances of the project being successfully completed decreases significantly. The uses of such plans is widespread and applies in any business venture. Our contingency plan will be devised to respond to a negative event, or a series of negative events that could impede the successful completion of the project. Given the unprecedent and unpredictable nature of the COVID-19 pandemic, this is an area of significant concern as any potential lockdowns as a direct consequence of the pandemic could result in absolute chaos. Hence, we need to plan for this event. Unexpected personal circumstances for a given team member may hinder their ability to carry out their responsibilities as outlined in their roles for a set period. Therein, we need to plan for such a situation. Finally, a plan will be put in place to ensure the project can still be completed if we run out of available funds.

## Sponsorships

We have endeavored and have reached out to a plethora of sponsors to acquire the funds required to carry out the project in its entirety. Due to the COVID-19 pandemic, however, we have found it difficult to do so. We are in continued discussions with potential sponsors; however, they have stated they would have a greater interest in doing so, once we have officially qualified for the competition.

## Budgeting

As Iryna Viter says, “a project without a budget is like a car without a fuel”, and this perfectly encapsulates our opinion on the creation of an accurate and detailed budget. Funding in our circumstance is essential to get the project started. Our budget will incorporate the combined costs of all activities, tasks, and milestones that the project must fulfil for successful and timely completion of the project. The importance of this cannot be understated. The numbers outlined in a budget will inform potential sponsors how much money is needed for the project to meet its expectations. A well-planned budget will also provide the basis for cost and expenses control. It will also give us an insight into how the project is progressing and if any changes to the plan created are necessary. Our process for the creation of the budget will be a bottom-up estimation. Our costs can be broken down into several different and distinct categories:

- Material resources
- Capital expenditures.
- Marketing expenses.
- Contingency reserves.

### Preliminary Budget

### Team Budget

2020/2021

F1 in Schools

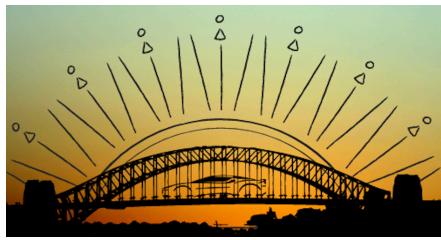


### Cash Flow

	Projected	Actual	Variance
Total Income	€3,200.00	€0.00	-€3,200.00
Total Expense	€3,071.25	€0.00	€3,071.25
Total Cash	€128.75	€0.00	-€128.75

# Marketing and Brand

## Logo



Our logo incorporates the suspension bridge that can be found in our locality. It is a symbol of unity in our team and represents the unification of different identity and viewpoints. The sunset present in the background of the image represents the bright hope we have for this project. It demonstrates the enormous ambitions we have, but it is also a symbol of beauty and perfection; which we hope to embody in our designs.

## Target Audience

Our target audience is rural communities in Ireland. We hope to promote STEM subjects in these communities. STEM subjects are crucial in the modern world in which we live. They permeate all parts of rural life, and by promoting these subjects; it will support innovation in rural Ireland, which is suffering from a brain drain to large urban areas.

Agriculture is a major part of Ireland's culture, and by targeting these communities; it will help advance and further develop the agricultural community in these areas. We think supporting these communities will be beneficial as they are often overlooked by the nation.

## Social Media

Our 3 primary social media platforms for publicly promoting our project will be Instagram, Facebook and Twitter. This will enable us to reach out to many people locally and internationally, who could be potentially interested in our team. We have many local social media groups, which we will request our pages be shared on to put the word out to our closely knit community. Good, consistent interaction with the public will not only gain the support of the public but will also be a contributing factor in finding support from a sponsor.

Once we are accepted to compete in regional finals, we will commence weekly posts and updates regarding our project to spark interest in our team and build up followers. We are aware we should take great care when sharing any information regarding our specific design concepts and its dimensions, to avoid any chance of plagiarism being committed against our work.

## Public Events

Due to COVID-19, we have found it difficult to arrange any sort of fundraising or promotional events. Despite this, we have investigated the following events to be organised with the necessary protocols and public guidance in place, within our school.

- Prior to Christmas Holidays, we are investigating the idea of hosting a table quiz sometime over the last week before school closes for the Christmas holidays. Due to the current global pandemic, this cannot happen in a conventional way, so instead we are considering calling out questions over a Microsoft Teams video call with all relevant classrooms. The logistics of charging for such an event that takes place during class time would certainly cause conflict, so we feel it would be more appropriate to ask students to support a raffle that we would run in tandem with this event. In the past, many raffles have been held in our school on special occasions such as our annual talent show, and have been highly successful in fundraising for events, charities and other projects. Local businesses are always very generous in giving prizes for such an event and this could provide a convenient means for small businesses to support us in a very cost-effective way. By selling tickets during a half time interval, we would have the best opportunity to raise the most amount of funds in a short period of time.
- In all scenarios, we will ensure that all potential fundraising and promotional events will be conducted in compliance with all relevant public health advice as outlined by the authorities at the time of the event.

## Team Uniforms

Working to a tight budget in our first year, will not allow for elaborate competition wear. We are currently looking into a very simple uniform consisting of a black soft-shell jacket, which we will have logos and sponsors' names embroidered onto. While we would have liked to have been able to advance our attire further, we feel that more essential items need to be prioritised with the limited budget we have.

## Website

Developing a website is now necessary in the contemporary world of marketing, and as such, we plan on launching a public domain website. We will use this website to share relevant contact details for sponsorship enquiries, information on our progress and regular project news updates. This website will be developed on GitHub Pages, which will allow us to turn a GitHub repository into a stunning website; while also allowing us to keep the code of the website open-source.