



PHOTONIC

ENTERPRISE PORTFOLIO
NSW STATE FINALS

in Schools Australia

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TEAM ROLES & RESPONSIBILITIES



Welcome

We are Photonic Racing, competing in the F1 in Schools NSW State Finals 2020. There are 3 of us in the team: Nick Hayes, Oliver Freeman and John Zhu. We strive to innovate, grow, excel and to shine brighter. Welcome to our Enterprise Portfolio.



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History

Photonic Racing is comprised of 3 members from teams Thrust Vector, Paradoxum and Awaken, with a combined experience of 7 past competitions, including attending the 2019 World Finals. We are now competing in Professional Class, and hope to excel in all areas of the competition.



Roles and Responsibilities

We are a small team of 3 members, but we have a lot of F1 in Schools experience, which we used to our advantage when planning roles. Due to the size of the team, we had to be very organised, and put a lot of thought into the allocation of roles and tasks. We evaluated each of our skillsets and team members' experience to decide on the best role for each, that would maximise our strengths and skills that we have developed during the competition over the last 3 years. We set out clearly defined roles for each of the team, so everyone understood their roles before we started. Also, very early in the project, we worked through all the project elements and deliverables, setting out requirements, who had the best skillset, procedures to get the work done, as well as goals and measures of success.

Nick Hayes - Team Manager & Design Engineer

As Team Manager, Nick is in charge to keeping tasks on schedule, and making sure the quality of the work is at the highest possible level. As he has competed in the F1 in Schools World Finals, he has a wealth of knowledge and experience about what is needed to run a successful team. As the Design Engineer, Nick spends a lot of time researching and designing the car. This is refined by feedback from the testing phases. Nick prototypes each design using his exceptional CAD software skills, as well as a wealth of knowledge about aerodynamics.

Oliver Freeman - Testing Engineer & Resource Manager

Oliver's role as Testing Engineer means he is responsible for the fine tuning of the car design, using aerodynamic principles, as well as virtual and physical testing to identify issues in the designs. He uses methods such as CFD and FEA to test the strength, drag, and airflow of each prototype. Feedback from testing creates new iterations of the car design. Also, Oliver manages funds and resources for the project, ensuring anticipated expenditure can be met and accounted for.

John Zhu - Manufacturing & Innovations Engineer

As Manufacturing Engineer, John plans, organises and oversees each phase of the manufacturing process and assembly of the cars. It is his job to ensure that every component is of the best possible quality, and manufactured on time. This includes G-Code creation, scheduling of CNC router, painting, 3D printing, and assembly. He also is mindful of innovation throughout the process.

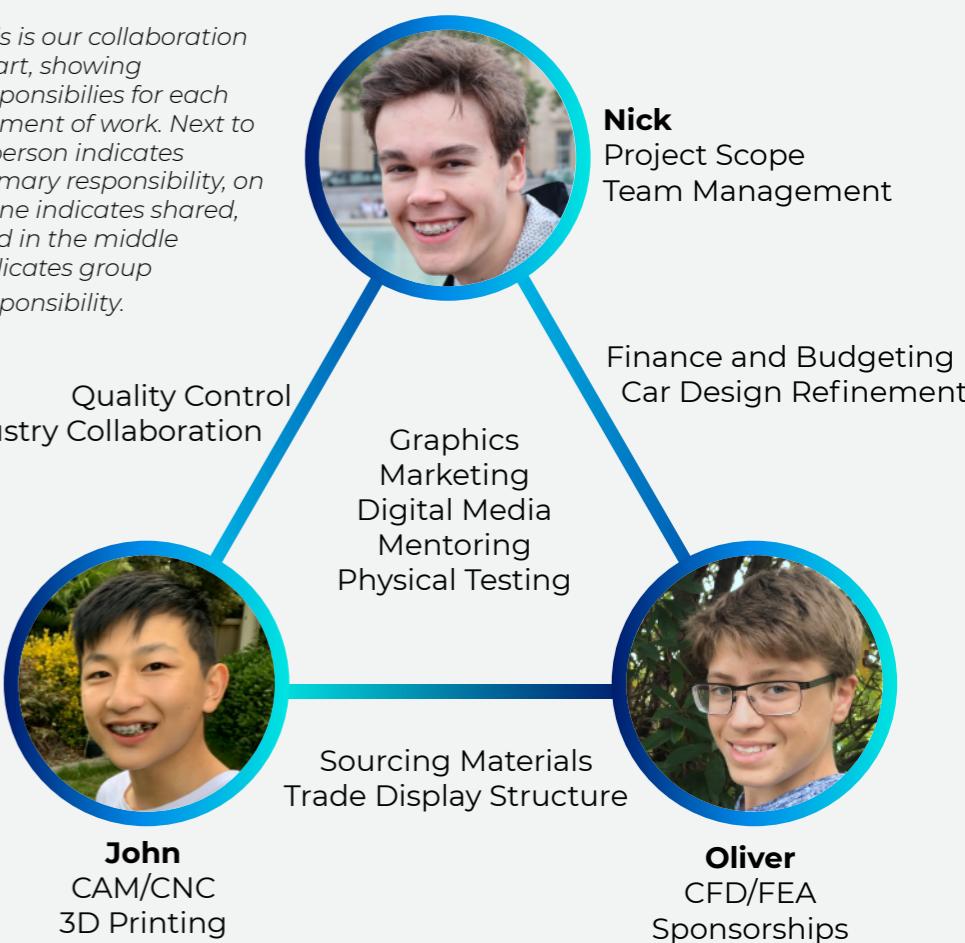
Interactions and Collaboration

As a small team of 3, we had the unique challenge of higher workloads than we had previously experienced in larger teams, but the advantage of flexibility and agility that a small team enables.

Our resource model was to clearly define our roles, but to also define the areas where collaboration would give us a real competitive edge. We identified areas of shared responsibility where collaboration would be maximised (see below). Every team member was familiar with all elements of the competition, what the requirements and goals were, what needed to be done when. We communicated frequently, and it was easy to organise regular team meetings either in advance or on the fly if required.

This model meant that each team member could lead the area that they had most experience in, yet be open to ideas, assistance, skills and experience from the other team members. This overlapping of roles and collaboration meant we could draw on the team's best skills throughout the project.

This is our collaboration chart, showing responsibilities for each element of work. Next to a person indicates primary responsibility, on a line indicates shared, and in the middle indicates group responsibility.



SCOPE & TIME MANAGEMENT



Project Planning Overview

For such a small team, we were very aware that managing our time and the project tasks would be critical to success. We undertook considerable planning in the early stages of the project, to ensure that the scope document focussed on the Team's deliverables, goals, components, responsibilities, estimated duration of tasks, and contingency plans. From there we also then created a detailed Gantt Chart to guide us in our tasks and timeframes.

As we communicated and met almost constantly throughout the project, we were able to track our progress against the detailed plans, amending and updating where necessary. This detailed planning and then tracking against plan worked well for us as a team.

Project Scope

One of the first tasks to be completed in this F1S project, was to break the competition deliverables down into project components and goals. This then provided us with a detailed scope document, a connection between the F1 in Schools State Finals Requirements for deliverables, and what we would need to do to complete those deliverables, with only 3 team members. Not just on time, but to the highest quality possible. The chart below is our Scope document, which details the components of work required to meet each of the deliverables. You will see that we identified the key components, who would be working on each, our estimated duration of these tasks, and contingency plans.

Project Deliverable	Project Goals	Components	Responsibilities	Time Planning	Plan Change Backup
Car	Extensive testing and refinement Innovative and justified design High quality manufacturing process	Testing Refinement Final Product	Nick - CAD Oliver - Testing and refinement John - Manufacturing	Expected Time Taken: 12 weeks Time Alotted: 16 weeks	Use most recent car design and begin manufacturing if design process not completed
Engineering Portfolio	Detailed information that meets criteria Visualisation of car refinement and data	Text Data Graphic Design	Nick - Graphics Oliver - Data and Charts All - Text	Expected Time Taken: 3 weeks Time Alotted: 4 weeks	Use available graphic design and data/charts to construct portfolio
Enterprise Portfolio	Detailed information that meets criteria Key summary of project management	Text Charts Graphic Design	Nick - Graphics All - Text and communication of project management	Expected Time Taken: 3 weeks Time Alotted: 4 weeks	Use available graphic design and data/charts to construct portfolio
Trade Display (Video Format)	Aesthetically pleasing and immersive design that engages and informs	Refinement Final Design Video presentation	All - Refinement of final design John - Video render	Expected Time Taken: 3 weeks Time Alotted: 4 weeks	If not enough time to render a video, use an image render of display.
Verbal Presentation (Video Format)	Meets criteria Presented in an engaging manner Innovative and memorable	Script Presentation Video	All - Preparation and production of video	Expected Time Taken: 2 weeks Time Alotted: 3 weeks	Spent 1 day dedicated to writing and filming the video, using available data.
Engineering Interview (Video Format)	Meets criteria Presented in an engaging manner Innovative and memorable	Proof of testing and refinement Clear communication of ideas Final Video	Nick - CAD criteria Oliver - Testing and refinement criteria John. - Manufacturing criteria	Expected Time Taken: 2 weeks Time Alotted: 3 weeks	Spent 1 day dedicated to writing and filming the video, using available data.
Enterprise Interview (Video Format)	Meets criteria Presented in an engaging manner Innovative and memorable	Proof of project management Clear communication of ideas Final Video	Nick - Graphics and team identity criteria Oliver - Project Management criteria John - Fundraising and Sponsorship criteria	Expected Time Taken: 2 weeks Time Alotted: 3 weeks	Spent 1 day dedicated to writing and filming the video, using available data.
Fundraising	Well managed budget Professional communication with sponsors and donators	Sponsorships (Proposal and communication) Donations (GoFundMe)	All - Sponsorship proposal John - Communication with sponsors and donors	Expected Time Taken: 8 weeks Time Alotted: 12 weeks	If not enough money raised, borrow from school and pay back later.

Above: Our scope planning chart, that allowed us to manage our project as well as possible

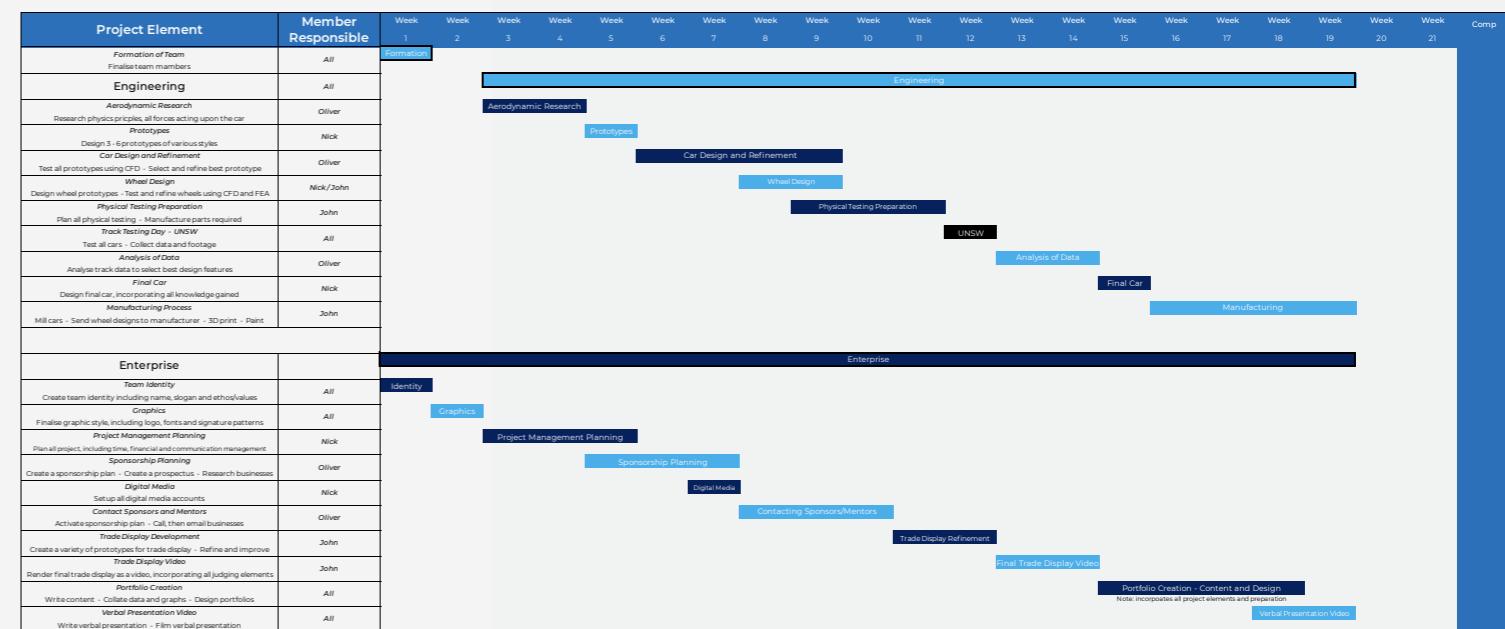
Time & Task Management

To translate our project scope document into daily and weekly tasks, we created a Gantt Chart. This identified the detailed tasks needed to be completed for each component of each deliverable. We also allocated the best skilled team member or the whole team, to tasks, planned the duration of each task, as well as start, end dates and the interdependencies. Setting this up at the start of the project, as an early planning task was extremely helpful. Our project planning was divided into the longer-term planning, composed of the initial planning stage, and refinement, and also, short term planning of day to day tasks.

Long Term Planning

Our long-term planning consisted of our overall project plan, breaking down components into tasks, and identifying start, duration, end dates, and task dependencies. To create this, we held planning meetings and created a Gantt Chart (see below).

We also took account other factors such as who should complete the tasks, who would be available, bearing in mind tasks durations and dependencies. One of our aims was to allow as much collaboration as possible between the 3 team members.



Above: Our Gantt chart, visualising the timeframes for our work required

As we progressed through the project, we reviewed completed tasks against the Gantt Chart, and assessed our progress to plan. This involved feedback from our short-term planning sessions that took place on a regular basis.

We built in a 2-week contingency into our project plan, to provide us with flexibility and a buffer against unforeseen issues. One such example is the COVID-19 situation that occurred at our school (BMGS) in September.

Short Term Planning

Our short-term planning consisted of daily or weekly meetings, as required. We would meet whenever possible, in person or by phone, as regularly as we needed to get the job done. We felt we had a great advantage being a small team, when it came to flexible meetings, that could be to the point. In these planning meetings, we would discuss progress to date, issues arising, work through solutions to those issues, impact on our timeline, and any changes required to the overall plan. We assessed our long-term plan, and also discussed what tasks needed completing in the coming week.

These consistent and frequent short-term planning meetings were invaluable to our team getting the work completed, collaborating, and working through anything that came up. This approach meant that all team members were up to date at all times, and we could focus our time and efforts on what really needed doing at any one time.

FINANCIAL & RISK MANAGEMENT



Financial Management

Financial management for Photonic Racing has meant obtaining funds as well as managing those funds by budgeting and anticipating costs.

In the early planning stages of the project, we decided to diversify our income sources, to avoid sensitivity to one area. Our approach was to include strategies for sponsorships, donations, and fundraising events. The aim was to have a 3-pronged approach, and thereby a greater chance of success in raising funds and sponsorships. Our final budget to date in raised funds is sitting at \$299.

Sponsorships

Sponsorships have been our primary source of income for this level of the competition, both in raising actual funds, and in provided services. For the NSW State Finals, we have contacted local businesses for sponsorship, and had mixed results. We created a Sponsorship Prospectus, giving each potential sponsor a price bracket and ROI options, to select from. We have managed to secure 6 main sponsors, one of which provided funds, the others provided services and mentoring.



Donations

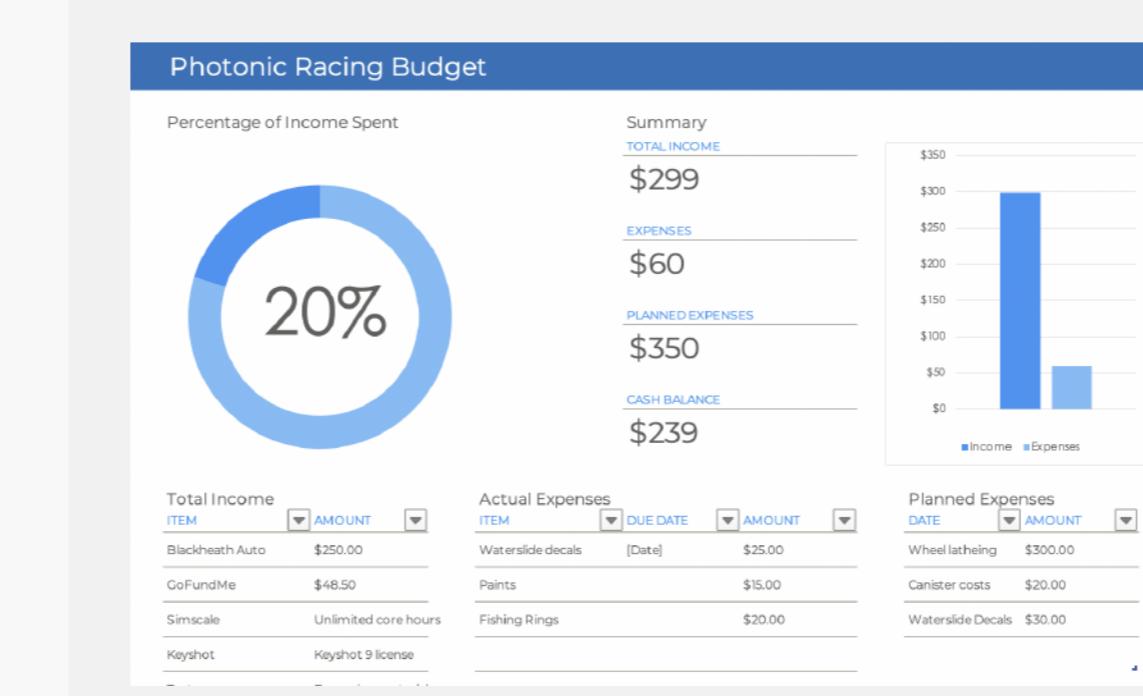
We set up a GoFundMe page for the purpose of generating individual donations, though we acknowledge that this was always less likely to generate substantial funds, it did bring in another \$50. We have links to the GoFundMe on our digital media platforms to assist in further fund generation.

Fundraising Events

We had planned to conduct a number of fundraising events such as stalls, workshops, race evenings or car shows. Unfortunately, due to COVID 19 restrictions we were unable to run these events. Fundraising events, not only raise funds, but they also promote F1 in Schools within the community. This could still be a possible path for future competition rounds dependent upon COVID 19 restrictions.

Budgeting

The budgeting process meant we had to create a comprehensive budget plan, which we did as part of our early planning phase. This outlined our expected income, and our anticipated expenditure. To minimise our need for cash spending, and therefore fund raising, we focused some of our efforts on securing sponsors that could provide services as well as materials, for example, printing, painting, and software licenses. We also created a resource inventory which detailed all the team's non-monetary assets. Once the project was underway, we assessed our progress against our budget plan each week, to identify any shortfalls in incoming funds, materials or services, to enable us to take further action if required. To date, we have only spent 20% of our income, considerably less than what we budgeted for.



Risk	Consequence	Matrix Score	Risk Reduction Strategies	Contingency Plan	Contingency Plan Trigger
Illness	Health issues, possible infection of others, inability to work	3 Moderate - Unlikely	Sanitise hands before using tools, wipe down desks after use.	Isolate until recovered, ensure online work is possible.	High temperature, not feeling well, cough/sniffle.
Injury	Possibly lasting health issues, inability to work.	3 - 4 Severe/Catastrophic - Very Unlikely	Always ensure knowledge of how to operate machinery, OnGuard safety tests	Call 000 if necessary, if minor injury, ensure online work is possible.	Loud Screams
Team Disagreement	Unfinished work, team disharmony	3 Moderate - Unlikely	Communicate frequently, allow everybody to have input.	Take a vote, or member managing project element decides.	2 people disagreeing, inability to compromise after 2-3 days.
Lack of Time	Unfinished project elements	4 Severe - Unlikely	Plan time using a Gantt chart, allow a buffer zone for unplanned setbacks.	For each element, create a backup option easily made in 1 week.	2 weeks until competition, project element nowhere near completion.
Lack of Funds	Unable to pay for expenses, possibly in debt	3 Severe - Very Unlikely	Plan finances using a chart, always budget extra for unplanned expenses	School will loan us funds if needed, giving us time to pay it back.	Expenses come within \$100 of funds
Unable to Complete Planned Work	Low standard of work, loss of points in competition	3 Severe - Very Unlikely	Always ensure team member assigned to role has proficiency in field	For each element, create a backup plan that is simple to execute	All team members unsure how to complete task to standard set

Risk Management

We undertook a comprehensive risk assessment to analyse and mitigate any risks involved with the competition, including personal and team-based. For each possible risk scenario, we designated it a score on our matrix, based on the likelihood of occurrence, and severity. We then attempted to reduce the likelihood and severity as much as possible, and created numerous contingency plans, and plans of action, to ensure we were well prepared.

Right Below: Our infographic budget, detailing and visualising our income, and planned vs actual expenditures

Below: Our risk assessment, along with our risk-severity matrix, detailing project risks, consequences and contingency plans.

Risk-Severity Matrix				
	Very Unlikely	Unlikely	Likely	Very Likely
Minor	1	2	3	4
Moderate	2	3	4	5
Severe	3	4	5	6
Catastrophic	4	5	6	7

COMMUNICATION & EVALUATION



Team Communication

To maximise the effectiveness of our team communication, and the resulting collaboration, we devised a detailed communication plan (see table shown). We pre-planned daily meetings, and messaging using Discord as our regular ways to collaborate and discuss. We also held weekly team meetings on Wednesday afternoons. File sharing and mentoring also featured heavily in our communication plan. By thinking through our approach and having a structured, yet flexible way of communicating, we were more effective and things flowed between us extremely well.

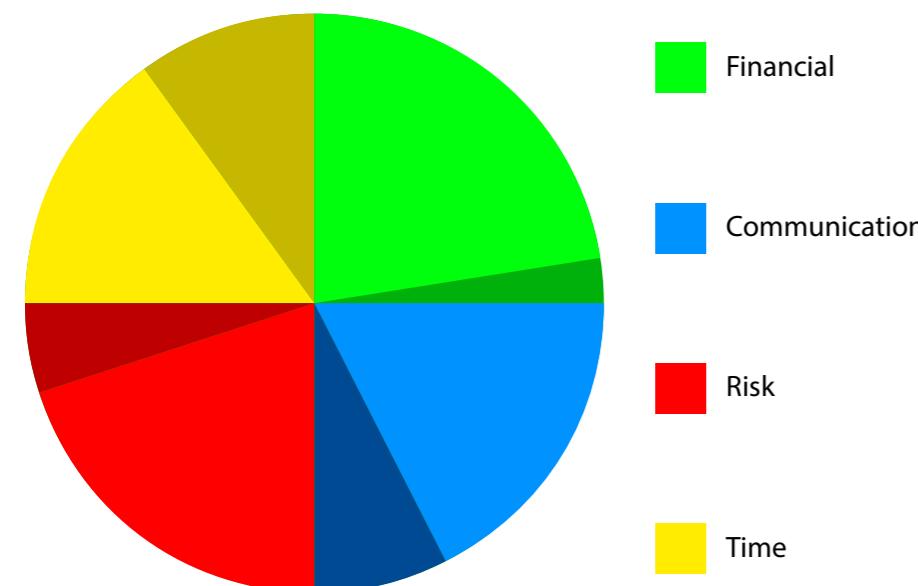


Communication	Method	Frequency	Goal	Benefits of Chosen Platform	Recipients
Team Discussions	In Person	Daily	Ensure all team members are fully aware of ideas, work required and project timeframes. Allowed for efficient collaboration on work.	Quick Easy to Organise Efficient	Team Members Teachers
Team Messaging	Discord	Daily	Used when team members are not together, allowing communication at all times. Quick and easy to use.	Always available Efficient Able to share photos/files	Team Members
Team Meetings	In Person	Weekly Every Wednesday	Scheduled team meetings for 2 hours every Wednesday. Allows efficient work and collaboration and access to school machinery and technology.	In-depth work possible All members present to collaborate Access to machinery	Team Members Teachers
Image / File Sharing	Google Drive	Always Available Files Uploaded as Soon as Complete	Cloud-based, so all team members can access. Allows sharing of large files and project elements, even when not in person	Cloud-based Organised Large file sizes available	Team Members
CAD Sharing	Onshape	Always Available Consistently Updated	Cloud-based, so all team members can access and view car design. Comments allow idea generation and conversation.	Ease of access Constantly updated Cloud-based	Team Members
CFD / FEA Analysis Sharing	Simscale	Always Available Contains all Engineering Data	Cloud-based, so all team members can access and view car airflow and part strength. Allows everyone quick and easy access to necessary data.	Cloud-based Private All data easily available	Team Members Jousef Murad (Mentor)
Sponsorship Proposals	Gmail	Initial Sponsorship Proposal - One Time Monthly Updates	Initial phone call to propose sponsorship. Follow up email containing prospects, and email used for all further correspondence.	Professional Easy to manage File transfers possible	Team Members Sponsors
Mentoring	Gmail / Skype	As Often as Required Usually Weekly	Initial phone call to propose mentorship. Further communication with flexible dates and methods. Gmail used for file sharing.	Flexible Face-to-face communication possible All members can access	Team Members Mentors

Above: Our communication planning chart, detailing channels of communication, platforms, frequency, goals and recipients

Management Evaluation

Throughout the process of planning and adhering to our competition preparation, we have evaluated, learnt from and refined our management methods, to improve in both short-term and long-term management.



Lighter Shade - % Areas Done Well

Darker Shade - % Areas Need To Improve

Financial Management

Our financial and sponsorship planning was completed early in the project, which assisted us in securing sponsors and funding. We updated our budget regularly, accounting for costs, and resulting in a budget surplus.

Improvement Actions:

- Spend more time obtaining sponsors, both for funds and services.
- Run fundraising events where possible.

Team Communication

We believe we took advantage of our small team size, and communicated very well, resulting in great collaboration, easy issue resolution, and a smooth-running project. Though we feel that communication is a team strength, sometimes our communication with other stakeholders, especially external ones, was less effective than we would have liked.

Improvement Actions:

- Communicate more frequently with sponsors and mentors, to reduce delays.
- Hold team meetings even more frequently when required to assist task completion.

Risk Management

Our risk management plan was created early in the project, which helped us throughout the project. The only issue that arose that dramatically impacted our schedule was a COVID 19 outbreak at our school. All team members were tested, and proved negative, but access to machinery and materials was impacted for more than 2 weeks. A full shut down of senior school premises had not been anticipated in our risk management plan, but we worked around the situation by completing as many other tasks as possible.

Improvement Actions:

- The plan needs to be more detailed.
- The plan should incorporate any impacts of COVID-19.

Time Management

We planned and monitored our time well, and adapted to changes in plans quickly and effectively. The Photonic Gantt chart proved very helpful, providing both a visual reference as well as detailed task and scheduling plans. Most tasks did take longer than expected due to balancing schoolwork with F1 in Schools project tasks.

Improvement Actions:

- Begin work earlier.
- Set more realistic timeframes.



FUTURE CAREERS

Linking Skills With Careers

F1 in Schools has introduced us to a wide range of industry and life skills. The skills that we have learned, and the experience we have had through this competition have given us valuable insight into a range of potential careers.

Through the management of our team, we have been introduced to project management, time management, financial planning, budgeting, and communication. In branding our team we have learnt about graphic design, digital media strategies, website development and programming, organizing events, community outreach, teaching and mentoring, and display construction.

Throughout the engineering process, we have learned about the design process, CAD software, CAM software, CFD and FEA, various aerodynamic and physical concepts, CNC routing, 3D printing and painting.

These skills and areas of knowledge that are promoted within F1 in Schools correlate closely with careers in the Australian Defence Force (ADF), or their industry partners.

The ADF offers a very wide range of career opportunities, spanning management, communication, public relations, engineering, and manufacturing areas, all of which correlate directly to skills that we have learnt during our participation in F1 in Schools.

Skills Learnt

Management

The management of our team has introduced us to so many skills that are relevant in almost every career, such as collaboration and interaction, project-work, time management and budgeting. These skills are used extensively in careers with the ADF, such as Accountant, Human Resources Officer, Logistics Officer, and Communication Systems Officer, areas where experience in planning, logistical thinking and effective communication are required.



Aerodynamics

During the design and analysis phases of our engineering process, we have learnt about aerodynamic principles that affect the performance of our car, and how to utilise them within our design. This knowledge of aerodynamics and design thinking is applicable in careers with the ADF, such as Aeronautical Engineer, Marine Engineer, Aerospace Engineer, or Airfield Engineer.



Manufacturing

Much of the experience we have gained through the manufacturing of our car is applicable to any manufacturing industry, including the ADF. The experience and skills we have gained are valuable in careers such as Electronics Technician, Aircraft Fabricator, Aircraft Painter, Equipment Maintenance, or Motor Mechanic.



Communication

The communication between team members and the wider community was key to our team outreach, and effective intra-team communication. We have learned how to communicate with others clearly, concisely and effectively, using a variety of methods. These skills are critical in careers with the ADF, such as Communication Systems Officer, Learning and Development Manager, Logistics Manager, or Psychologist.



Branding

Throughout the development of our branding and team identity, we have gained experience in the creation and marketing of a brand. We have also learnt about graphic design, video production, website development, just to name a few. These can be implemented in careers such as Public Relations, Public Affairs Officer, or Liaison Officer.



Future Careers

Nick Hayes - Flight Test Engineer

I would love to become a flight test engineer with the Department of Defence, analysing the mechanical state of various aircrafts to determine flight safety. This also involves repairs and analysis to ensure all planes and helicopters are safe to fly. I have visited the RAAF base, and seen new Lockheed Martin aircraft, sparking my interest in this field. F1 in Schools has helped me with my critical thinking and analysis skills, creative thinking and innovation skills, and general engineering skills.

Oliver Freeman - Geospatial Intelligence Analyst

I have long been interested in maps and navigation, but had never previously conceived a career in this field. Becoming a geospatial intelligence analyst for the Australian Army sounds like an amazing job, photographing, surveying, mapping, and making models of various terrains and areas to provide geospatial intelligence to the Army. This field needs precision measurements, and careful collection of data, things that F1 in schools has helped me greatly with.

John Zhu - Aerospace Engineer

Before F1 in schools, I had no idea about my future career paths, but I now have a great interest in designing and aerodynamics, and would love to become an aerodynamic or aerospace engineer with the Australian Defence Force. The main work involved is the maintenance of the Navy's fleet of helicopters, but there is the potential to work on various other projects. F1 in schools has opened my eyes to a multitude of career paths that I hadn't previously considered.



Left: An example of work on helicopters, involved in a career as a flight test engineer or aerospace engineer

SPONSORSHIP & FUNDRAISING



Fundraising

To manage our approach to fundraising and sponsors we created a financial plan. This detailed our expected expenses, our fundraising methods and targets, our actual budget and any contingencies.

Fundraising involved setting up a Go Fund Me page to secure individual donations, as well as approaching sponsors for funding.

Sponsorships

As sponsors are our primary source of income we created a comprehensive sponsorship plan. This plan details our strategy, on what businesses we planned to target, what return on investments we could offer, how we would contact potential sponsors, and so on. For the NSW State competition, we have targeted NSW and local businesses, as they will achieve greater ROI in the competition's geographical area. We also were mindful that we could utilise any local connections we have in the area we reside.

If we progress to the National competition we plan to expand our focus on a national scale. We have a Sponsorship Prospectus which we emailed or provided hard copies to prospective sponsors. This provided information on F1 in Schools, who are team is, as well as the ROI opportunities.

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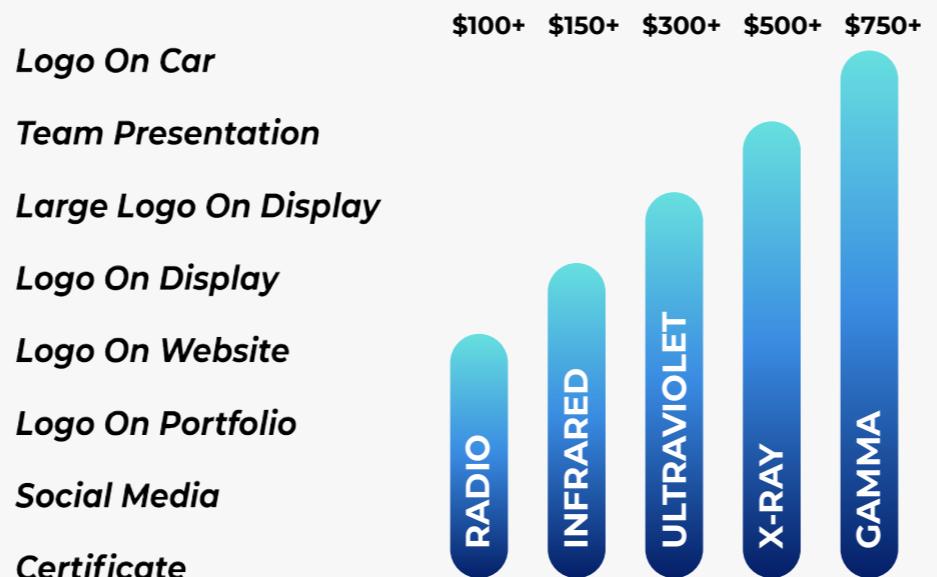
 KeyShot

Left: Our sponsors

Sponsorship ROI

We created a return on investment plan for sponsors, which was detailed in our prospectus. The different levels of sponsorship offered differing levels of exposure to the local community, and therefore advertising opportunities. These included logo placements on website, social media, trade display, or on the cars. We also offered a team presentation to the company if they wanted to arrange one. This is more aimed at medium to larger businesses, who wish to show their employees or investors what their donations go towards.

We also offered tailored sponsorship if businesses preferred.



Above: Our ROI plan, with various sponsor benefits for each progressive tier

Mentorship Prospectus

For each potential mentor or industry group that we planned to contact, we created a specific, 'personalised' mentorship prospectus. This was similar to our sponsorship prospectus, but allowed us to explain in greater detail about the competition, and what we were looking for from a partnership with that mentor. For our mentors, we allowed flexible ROI options, as we wanted to promote them as well as possible, to allow effective ROI for both parties. Our mentorship prospectus allowed us to reach out to specific individuals or companies, increasing our connection and likelihood of gaining mentorship.

Contacting Sponsors

To contact our chosen sponsors, we have created a plan to ensure that we engage the businesses as much as possible, and so every team member has a professional approach when contacting potential sponsors.

- 1.** Call the sponsor and introduce our team and the competition. Ask for the contact of someone who can manage sponsorships.
- 2.** If we get the contact of a different person, call them, introduce ourselves and the competition, and inquire about sponsorship.
- 3.** Send a follow up email further detailing the competition, and reasons for sponsorship. This will also contain our prospectus.
- 4.** If sponsorship is agreed to, ask the sponsor about the amount they will donate, and any specific ROIs they would like.
- 5.** Agree on terms of sponsorship.
- 6.** Email a sponsorship invoice, containing details of sponsorship level, ROIs, bank details, and business details.
- 7.** Once funds are received, email a sponsorship receipt containing confirmation of deposit.
- 8.** Follow up with agreed-upon ROI activities, including monthly progress emails to ensure that sponsors are engaged.

Note: if at any point sponsorship is declined, send an email thanking them for their time and consideration of our proposal.

MARKETING



Marketing Overview

The aim of marketing in the F1 in Schools competition is to secure funding, engage sponsors and mentors, as well as to increase the profile of the competition, and our team, as much as possible.

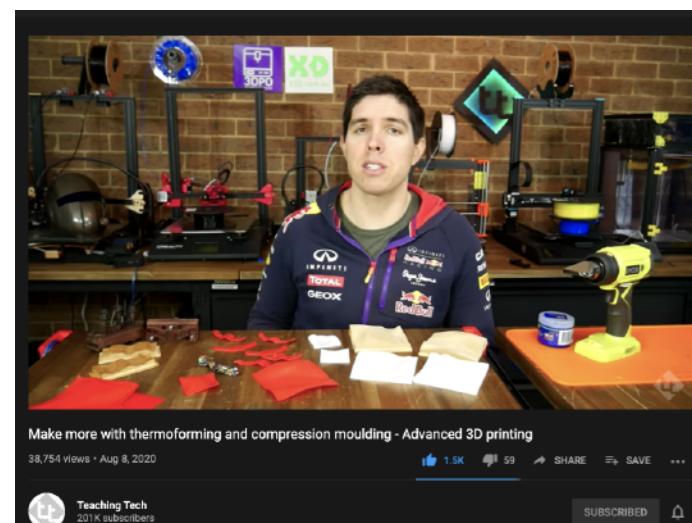
In order to achieve this, we have used a variety of strategies. Such as, using a variety of digital media platforms to promote our team, the creation of our school, BMGS, F1S Co-Curricular program, and the engagement of one particular mentor to reach a wider audience.

Our approach has been designed to maximise our outreach to as many different demographics and communities as possible. All our platforms have our team branding, and graphic design images to promote a recognisable brand.

Teaching Tech Youtube Video

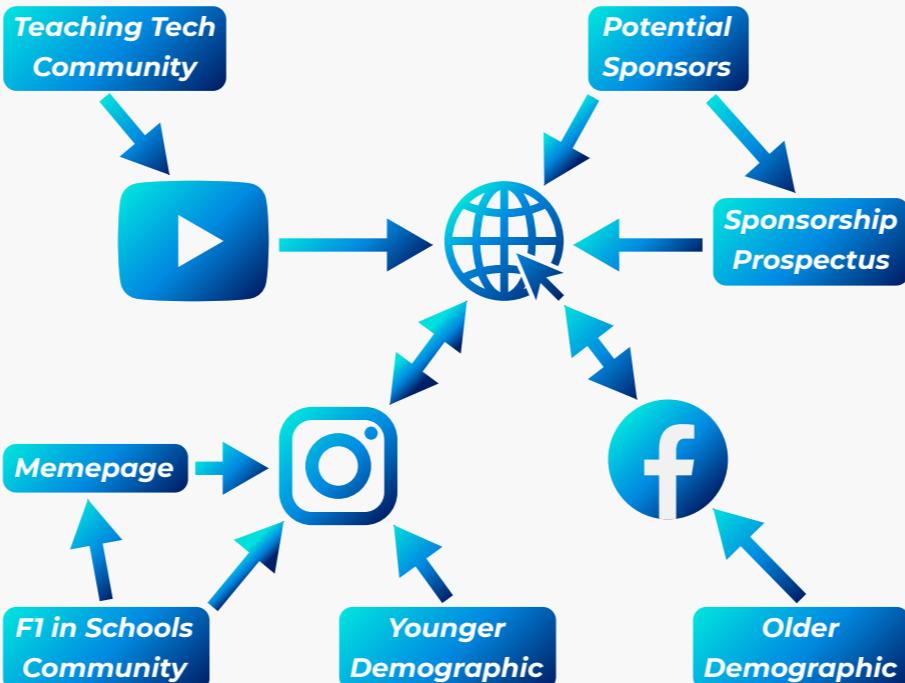
We have partnered with a mentor, the You Tube Channel Teaching Tech which has an audience of over 200,000 subscribers. Together we created a video, testing and exploring the process of thermoforming plastic, an innovative technique that could be used in future competitions to manufacture parts.

We are featured in the video talking about the team, and how we could benefit from the thermoforming process. The video included testing performed by our team, interviews with our team, and links to our digital media platforms. This opportunity has been invaluable to our team and marketing our brand, as well as allowing us to promote F1 in Schools to a wider audience. We have been offered additional mentorships from viewers of the channel as a result of this video.



A frame from the introduction of the YouTube video, with the testing materials and our prototype thermoformed rear wings.

Digital Media



Website - <https://photonicracing.github.io>

Our website is directed at anyone who is seeking to learn about the competition and our team, so it is easy to use and read, and includes information on our team and F1S. Our website is linked from all our social media platforms, such that it can be easily found. The website has been written from scratch, not using website services such as Wordpress or Wix, so that we have complete control over our branding on our website, without any cost.

Instagram - @photonicracing

We used our Instagram pages to connect with a younger demographic, and the F1S community. We post on our main account regularly, to provide updates and showcase sponsors (one of our ROIs). This keeps our followers engaged.. We also use a separate account to further expand our audience (see next column).

Facebook - @photonicracing

Our Facebook account was targeted at an older demographic, as it is the most popular social media platform amongst adults. We could provide updates and promote our sponsors to adults, who are the primary target market for most of our sponsors. We have also links to our website, so adults who are unfamiliar with F1S can learn about it and our team.

Community Involvement

F1 in Schools Co-Curricular Program

To raise the profile of not just our team, but F1 in Schools as a whole within our school community, we have designed, organised and run an F1 in Schools co-curricular program for any students wishing to compete. This allows anyone in our school, in any year to compete, as previously F1 in Schools was limited to the Design and Technology classes. We hold mentoring sessions once a week, after school on Wednesdays for all teams competing, to teach them the skills required, and mentor them as they do their work. This program is already showing its success, with BMGS achieving a 1-2-3 finish for its Development Class teams at the Western Sydney Regionals, and our first co-curricular team placing first in nearly all categories.



Photonic mentoring one of the BMGS Development Class teams Peak in our co-curricular program.

Left to right: Nick Hayes, Nick Collins, John Zhu, Connor Snedden

Secondary Social Media 'Meme page'

In addition to our primary digital media platforms, we have developed an innovative and creative method of reaching out to as many people involved in the F1S global community as possible. We run a page on Instagram where we post satirical content on a variety of topics relating to F1S, often referred to as a 'meme page'. It is called 58GramsNeverAgain, and we regularly post humorous and relatable memes, specific to F1S Doing this allows us to specifically target the F1S community, in a unique, innovative, memorable way. From this page, which has a much larger audience than any of our primary media platforms, we can market our team, and redirect followers to our primary media platforms, to a much broader and more engaged audience than our primary social media platforms. Some of our content has attracted audiences outside of F1 in Schools, such other REA programs and people from the wider STEM community.

BRANDING



Primary Branding

Team Name

Our team name is 'Photonic Racing', which refers to the photon, a particle of light, and the fastest known thing in the universe. We aspire to race as fast as possible, so our name reflects this. Our name also reflects how we want to 'speed past the other teams' in the competition, which touches on our main goal, to win each competition. Our name expresses our desire to be our best, to innovate, and to 'shine brighter'. This was the culmination of extensive ideas and refinement, having prototyped names such as Vanguard, Omni Racing, or EmbRace.

Logo

Our logo has had many prototypes and refinements, before choosing our final design.

Below is a selection of our initial logo designs.

We have 2 logos, our primary logo, and our secondary, or icon logo. This allows us high versatility in our branding and ensures we can use a logo in any situation and remain recognisable.

Our primary logo is a reference to a photon particle itself, symbolising our aim to make the fastest F1S car through the fastest entity in the universe. The logo is also a reference to a photon 'ring' or 'sphere' that surrounds a black hole where any light travels in a perfect, uniform sphere, and this encapsulates our work ethic in we want all our work to be as perfect as possible. The three segments of the logo symbolise our three original teams: Thrust Vector, Paradoxum, and Awaken, and how they come together to form one.



Additional Branding

Slogan

Our slogan is 'Shine Brighter', referencing photons, which are particles of light, and it also signifies our desire to shine as much as we can in this competition, and to innovate and to perform in the best way possible.

Colours

We have utilised a blue colour palette on white, which is a clean, sleek and modern combination, and also is reflective of our local area; the Blue Mountains. We have 3 shades of blue which we use and create our gradient from:

Bright Turquoise - RGB 0, 229, 225

Azure Radiance - RGB 0, 139, 233

Midnight Blue - RGB 0, 27, 106



Fonts and Typography

Our team font family is Montserrat, which we use on all of our branding, ensuring all project elements are consistent. We chose this, as it is a clean, modern and understated font that is easy on the eye. It is also a font family, meaning we can choose a variety of font thicknesses for various uses, while still keeping our branding consistent.

Title Page 1

Title Page 2

Page Heading

Subheading

Body Text

Image Captions

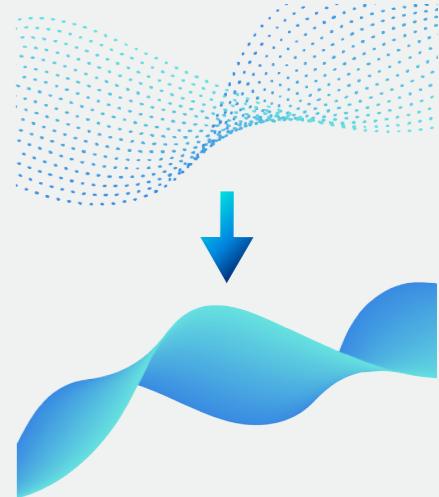
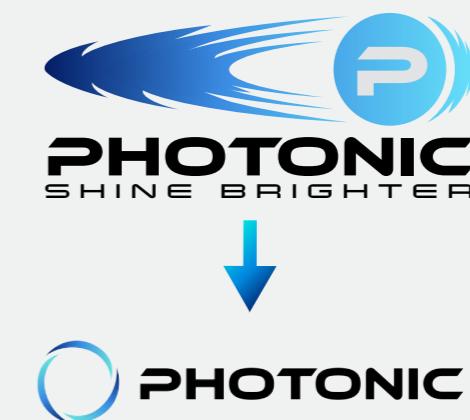


Branding Wave Pattern

To complement our branding, we have created a signature pattern that matches our branding. It is a wave structure, created from our team gradient, that we can use to fill space, or as a border. This links into photons, as light, behaves as a wave, strengthening the connection to our branding. We created our pattern in Adobe Illustrator.

Branding Redesign

After the Western Sydney Regional Finals, we decided that our branding was too complicated, and we wanted a much more clean, sleek, and simplified aesthetic. We completely redesigned our logo, and gave our signature wave pattern a facelift. We finalised this before we received our results for the competition in hope that if we got through, we would announce our result with our new branding. For this, we produced a sophisticated branding reveal video, showing the transition from the old to new designs, for our social media platforms.



Merchandise

Because of COVID-19, our merchandise options were very limited. However, we still see merchandise as an effective method of spreading our team branding within our local community. Our previous teams had successful experiences with merchandise, both as a way of promoting our team brand and as a method of income. Because of this we decided to release a wide variety of Photonic themed wallpapers as 'virchandise' on our social media platforms.

TRADE DISPLAY



Uniform Design

Though we cannot produce a physical uniform, we have still designed uniforms for future use in the competition. Our team shirts are simple, clean and visually pleasing, with the key visual element of the design being our signature wave pattern sash. Running from the bottom corner to under the shoulder, it is bright, contrasts with the white of the shirt, and is instantly distinctive and recognisable. Each team member has their name and role on the front of the shirt. On the back of the shirt are our team sponsors, and the F1 in Schools corporate partners, separated by the sash. These shirts are designed to be worn with plain black pants, and black shoes, articles of clothing owned by all team members.



Trade Display Structure

Even though this competition is virtual, meaning we do not have to produce a physical display, we have still given extensive thought to the structure and construction of our display. We have decided to utilise lightweight cardboard for the structure of our display, as it is cheap, can be flat packed for transport, is easy to set-up, is strong, and most importantly, recyclable. We have an extremely innovative design that utilises cardboard and reduces setup time to just seconds. We can laser cut cardboard, pre-assemble the display, can flat pack it for transport, and merely lift it to create the structure. All of our poster boards will also be printed on cardboard, including the boards that attach to the front of our table, as it can achieve a clean sheen and high-quality print while remaining reasonably recyclable and have a low environmental impact. All of our structure can fit into the required staging zone. Our booth has been considered and carefully planned to be easily transportable, quick to set up, fully legal, strong and environmentally friendly.

Design Refinement

To begin the design process for our trade display we decided on requirements we wanted to meet. We wanted our trade display to be immersive, well-organised, promote our car, brand and sponsors, and to be aesthetically pleasing. We then created a number of prototypes for our design, each with different styles, and methods of displaying props, ICTs, and information to the viewer. We then chose our best design, which was modelled on a real F1 pit wall. We then created numerous different types of this pit, each slightly different, but in keeping with the F1 pit wall style. Once we had decided on our final design, we discussed where we should place props, merchandise, booklets and information to best engage the viewer, while maintaining an uncluttered look. Once we had decided on our final design, we could begin our graphic design and rendering process, to create our final trade display.

Right: An image of our proposed trade display

Left: Our uniform concept design

Trade Display Design

We have designed our trade display to be as interactive, informative and memorable as possible, through our structural design, information design, use of ICTs and technology. We have made our car the key visual feature of the display, highlighted as the salient image, in the centre of our booth, and we have incorporated a turntable in the centre of our table to showcase the physical model to visitors. We have also been innovative in the design of our display, as we chose to mimic a real F1 pit wall, using 3 large touchscreen monitors to create an interactive element. These monitors can be used by viewers, and show videos, documents and project elements that we have created, to allow them an interactive and memorable insight into our team and our competition preparation. Another key element to our display is our integrated holograms, which light up at the touch of a button. These use parabolic mirrors, embedded in the table, to show different parts of our car to viewers in a technologically advanced, and unique way. Holograms are useful, as they only show up when somebody is pressing the button, meaning they do not clutter the display when other elements are being viewed. We have displayed our information as cleanly and as clearly as possible, so viewers can see our journey easily. On the left of the display, we have information about engineering, and on the right is information about our enterprise. We have incorporated information as visually as possible, with the use of infographics, to minimise the amount of text to be read. Overall, we believe our display is well branded, engaging, innovative, unique and gives readers as much information about our team as possible.



INDUSTRY MENTORS



Industry Mentors

To assist us in our learning, and our competition preparation, we have sought out various mentors in industry-related fields. Gaining mentors has allowed us to learn about a wide array of topics, enhance and improve our skills, and gain experience from talking to industry experts. This has been extremely valuable to us, both for the competition and for our personal skill development.

Teaching Tech

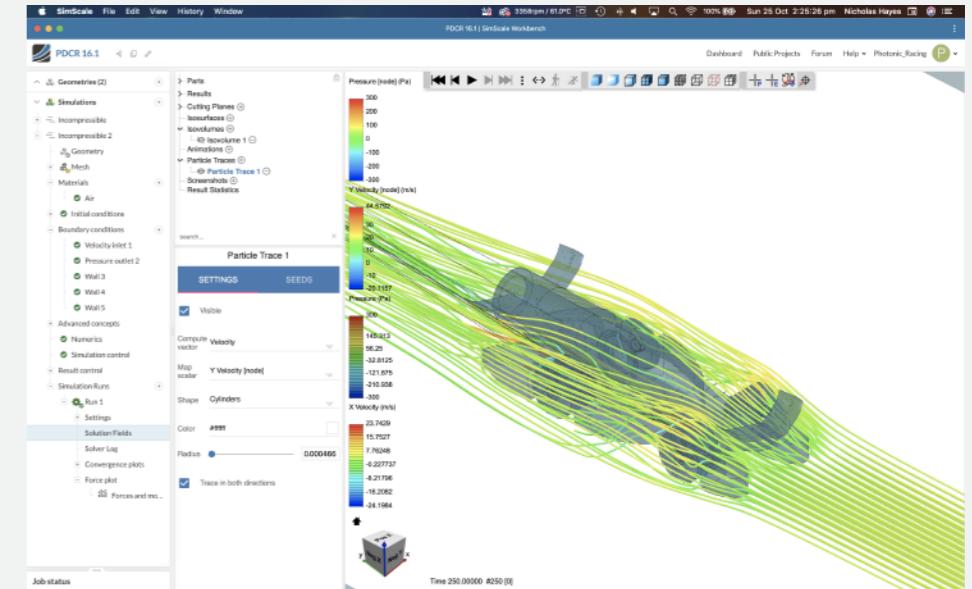
We have been mentored by Michael Laws, from Teaching Tech, a CAD, CAM, CNC router, 3D printing and graphic design YouTube channel. He has a wealth of experience in design, manufacturing, technologies and branding, all skills that are hugely important for our team in this competition. He also has previous experience with F1 in Schools, having been a teacher, and taken students through the competition for over 7 years. This experience has been invaluable to us, as he knows how we can improve our engineering and manufacturing processes. He has introduced us to several concepts in a variety of areas, such as building a filament shredder to recycle and reuse old prints, using silicone mould casting to create perfect parts.



Above: Our team, featured in a Teaching Tech YouTube video

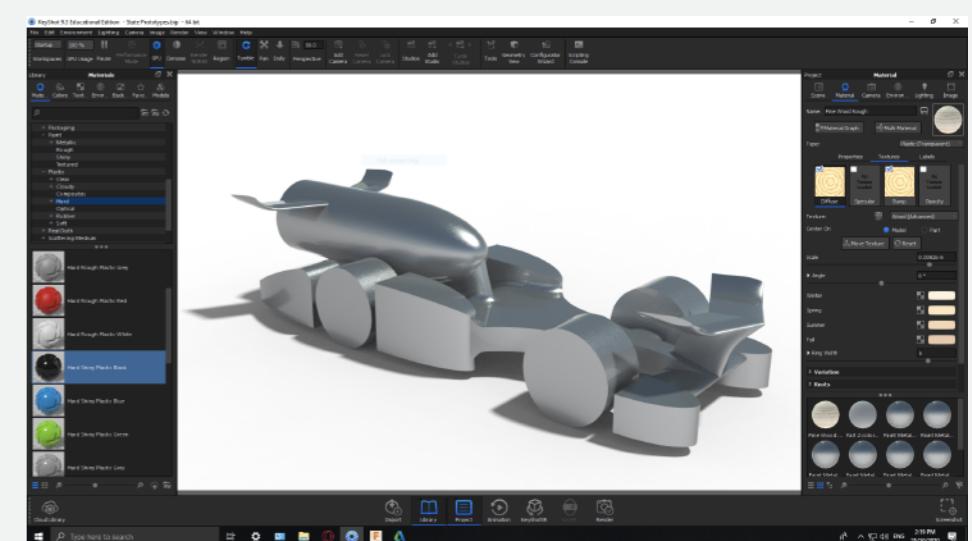
Simscale / Jousef Murad

We have been given access to Simscale's industry-standard CFD and FEA software (see upper right), and have used it extensively in the analysis and refinement of our car design. Jousef Murad, Student Ambassador for Simscale, who is based in Munich, Germany, has been mentoring and helping us, frequently communicating via email. He has taught us how to best utilise Simscale's features, and how to set up simulations to gain data that was relevant to our needs.



KeyShot

We have also been sponsored with software from KeyShot, an industry leader in real-time rendering. They have provided us with KeyShot 9 (see centre right), their premier rendering software package. We have been mentored by Emily Zirkle, head of KeyShot's Education Program. She has taught us how to use KeyShot 9 and has given us advice on meshes, colours, decals, lighting, environments, as well as showing us how to use animations, and how to minimise render times, enhancing our efficiency. She has been a great mentor to us, and we now are so much more skilled and knowledgeable in renders and rendering software.



Paradoxum / Zach Burgess & Matt Foster

We also received mentorship from Zach Burgess, and Matt Foster, from 2019 World Finals team Paradoxum. Zach's role was as Marketing Manager, and Matt was the Graphic Designer. Both of them, in addition to our Team Manager/Design Engineer Nick, have extensive experience as competitors in F1 in Schools and have great insight into what we should do to maximise our success. They have mentored us in the branding of our team, in elements such as logo, colours, typography, digital media and community outreach. This was our main focus given that they won the Digital Media Award at the 2019 World Finals (see lower right). We have been in consistent communication with them, at most of our weekly meetings, and they have been extremely helpful to us.

