Project Management Portfolio |
2022 World Finals |
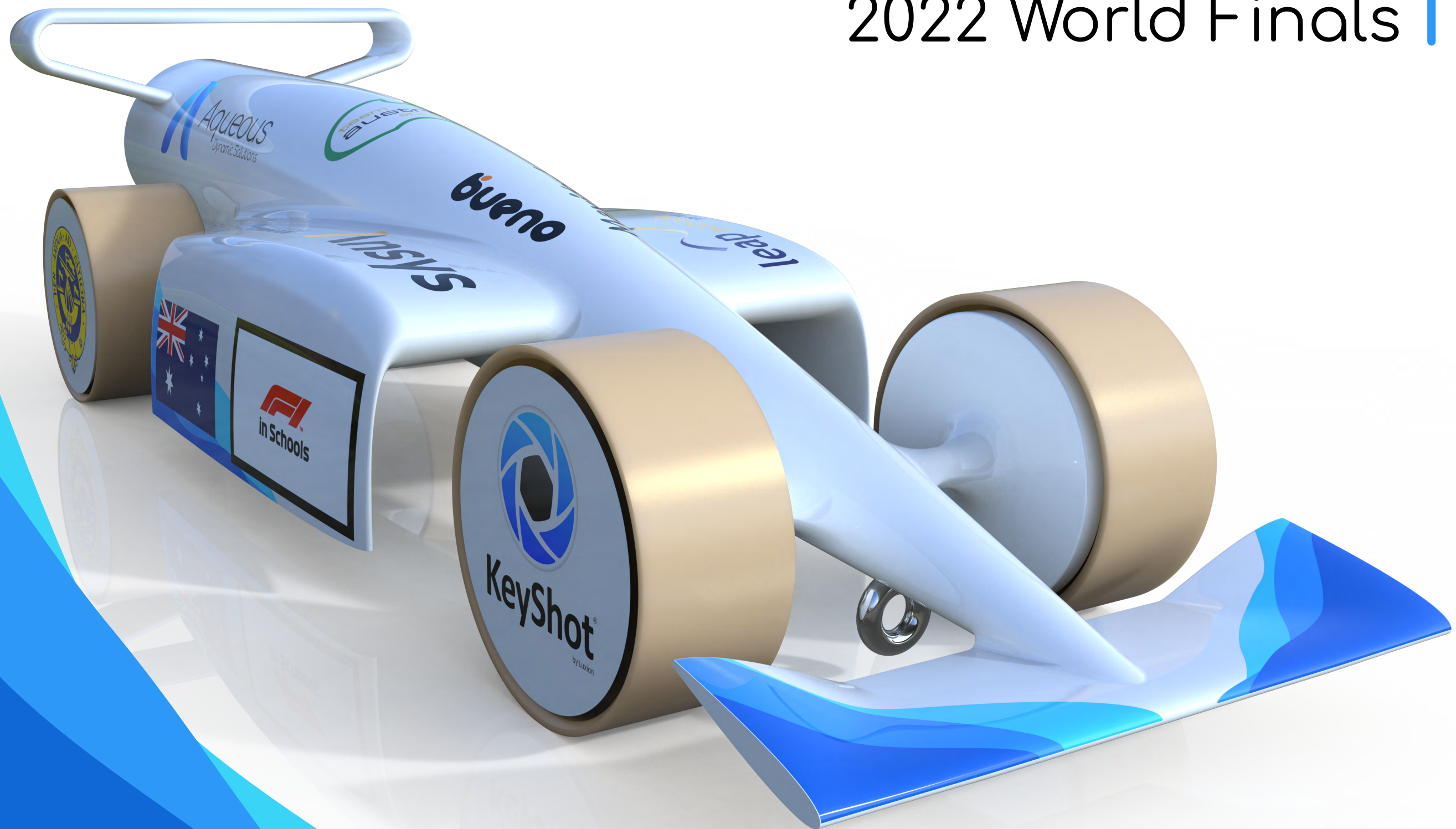
Aqueous
Dynamic Solutions

Defining the Project

Why

The project was initiated aiming to improve our understanding of the STEM subjects through competition, as well as allow the practice of project management strategies.

Who

Aqueous' participation will involve the team members and other members on the stakeholder register.

What

Deliverables to be produced are covered by the F1 in Schools Competition Regulations. These deliverables include cars, a pit display, enterprise and engineering documentation, a verbal presentation, and marketing/engineering strategies. We aimed to produce a maximum quality submission, with resources and funding provided through sponsorships and industry collaborations.

When

These deliverables will be produced in preparation for the competition in April 2022, and completed as per the project schedule. Our progress throughout the project will be monitored as per the monitoring/controlling plan, ensuring deliverables are ready before the deadline.

Where

Physical deliverables including the cars and trade display will be used for racing and presentation at the F1 in Schools 2021(22) World Finals in the United Kingdom. Should the competition be hosted virtually, deliverables will still be presented online.

How

We will produce deliverables using the combined experience and knowledge of team and affiliate members, in addition to resources provided by the network of stakeholders, mentors and sponsors. We will measure quality and progress as per the control plan. Success will be measured based on the feedback from judges in the competition and our results and performance.

Project Charter

The project charter was drafted immediately after the initial meeting. Following the National stage of the competition, both teams examined feedback and scorecards to determine areas requiring improvement.

The charter highlighted the ultimate goal of Aqueous in the competition; to improve our understanding of STEM, and become F1 in Schools World Champions. It allowed us to clearly communicate the parameters and expectations of the project between each team member and outlined learning outcomes, milestones, assumptions and constraints.

A review of media also allowed Aqueous to outline and determine the risks posed by the Covid-19 pandemic. By signing the document, each member committed to the highest standards required by this competition and acknowledged this critical information. This component of the project initiation process ensured the team started on the same page, and that the project was authorised and understood appropriately by all members.

Figure 1 - A sample set of pages from our project charter (source: team files) See https://teamaqueous.com/files/project-charter.pdf

Initiation Meeting

The members of Aqueous from both Newington College and Blue Mountains Grammar School, as well as relevant supervising mentors and adults, held an initial meeting in June 2021 at Re-Engineering Australia Foundation's headquarters. This meeting allowed the teams to determine engineering and enterprise role allocations, and differentiate between core and affiliate members. Project management and communication strategies and platforms were also standardised.

At the initial meeting, Aqueous decided that innovation, adaptation and collaboration, both within the team and with industry and external stakeholders, would be the focus of our team. Based on these core values, it was decided that our brand summary statement would be:

"Dynamic solutions through innovation, adaptation and collaboration"

Figure 2 - The initiation meeting at REA's HQ (source: team files)

Key Deliverables

We identified six major deliverables that are crucial to the success of our team's project, aligned with the criteria of the scorecard. Thes deliverables include:

- Two race cars, and associated engineering components
- Trade display and video
- Verbal presentation and video
- Portfolio documentation
    - Project management portfolio
    - Enterprise portfolio
    - Engineering portfolio

Objective & Acceptance Criteria

Our main objective for the 2021(22) F1 in Schools World Finals is as follows: to have the most points awarded and be titled the 2021(22) F1 in Schools World Champions.

To achieve this goal, we formed acceptance criteria regarding the key aspects of the F1 in Schools competition.

For the engineering component, we need to design and manufacture an innovative and fast car.

For the enterprise side, we aim to create a striking, strong, and recognisable brand to apply across our team to fulfil our project deliverables.

About the Project Scope

Our project scope encompasses all aspects of the competition. Aqueous believes that effective and thorough planning is critical to success in any project, and so designed a project scope to define and control work done.

The project scope is based on information within the Aqueous Project Charter, and covers all related skills, resources and activities, timelines and restrictions of participation within the F1 in Schools World Finals. As a new team on the international stage, it is critically important to ensure our project scope is understood and applied by all members of the team. A clear well-defined scope also assists us in overcoming the challenges of working as a collaboration team between two separate schools.

The parameters of our project scope are governed by key performance indicators (KPIs) - these are quantitative factors of F1 in Schools that are objectively examinable, and important for progress throughout the competition. For example, some of our performance indicators included reaching a certain level of online interaction in a set time, or developing the prototype such that a certain maximum speed was obtained. We applied these performance indicators to ensure Aqueous was working productively in the right direction.

The project scope and parameters are continuously evaluated throughout the season after analysing the performance indicators, based on insights from members of the team and our mentor support network, and changes in the work environment. For example, lockdowns and international travel restrictions may impact the timeline of our project, and the nature of the deliverables. Based on this information, a detailed and systematic work breakdown structure is created.

Overall, the project scope was a critical tool in planning Aqueous' approach to the project, and ensured productivity and clear communication despite working from different schools.

Project Schedule

Aqueous outlined a Project Schedule that explicitly indicated the nature of the deliverables that needed to be completed by certain deadlines, and outlined the resources necessary.
Our project schedule incorporated each of these factors and was drafted as a team.

Deliverables

With the aim of succeeding in the World Finals, our project schedule set deadlines for key milestones including the completion of enterprise and engineering portfolios, development of brand and marketing strategies, completion of design and manufacturing process, and the dates of the competition. Each of these deliverables is subdivided into smaller goals or subcategories for a more clear and concise project management system - for example, the formation of a team brand is divided into logo creation, the establishment of brand guidelines and social media, etc. This is summarised in the Gantt Chart below.
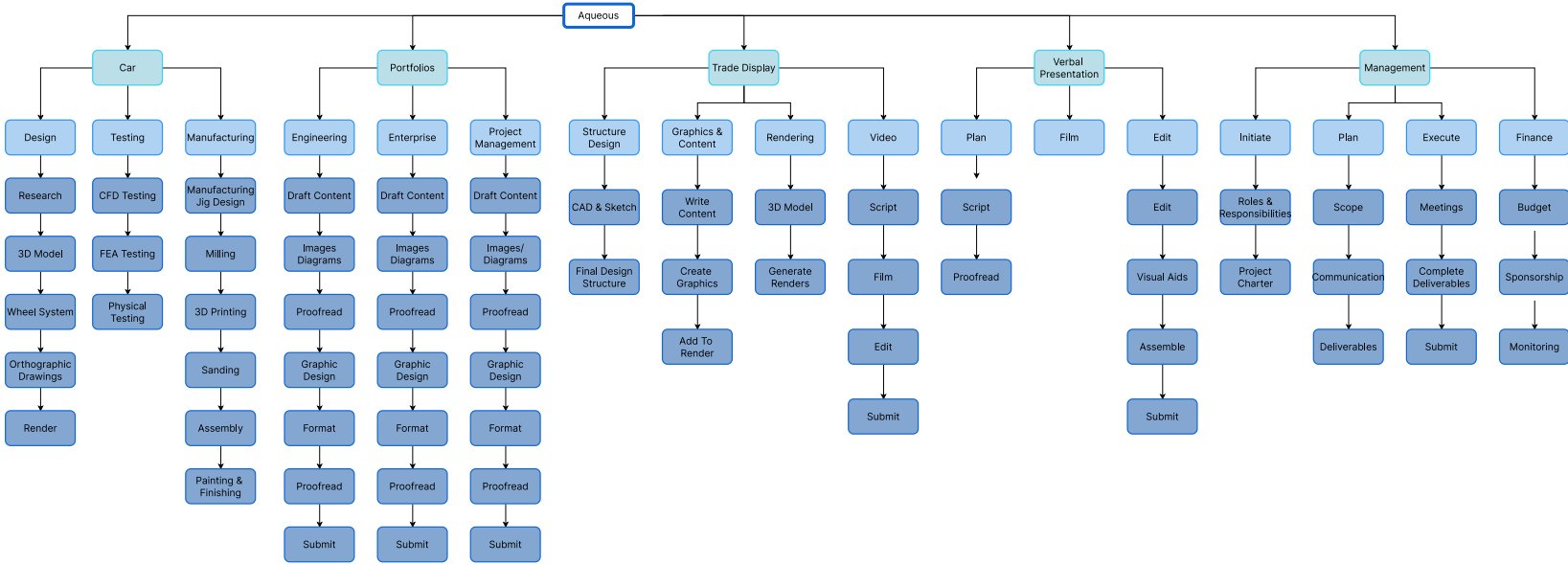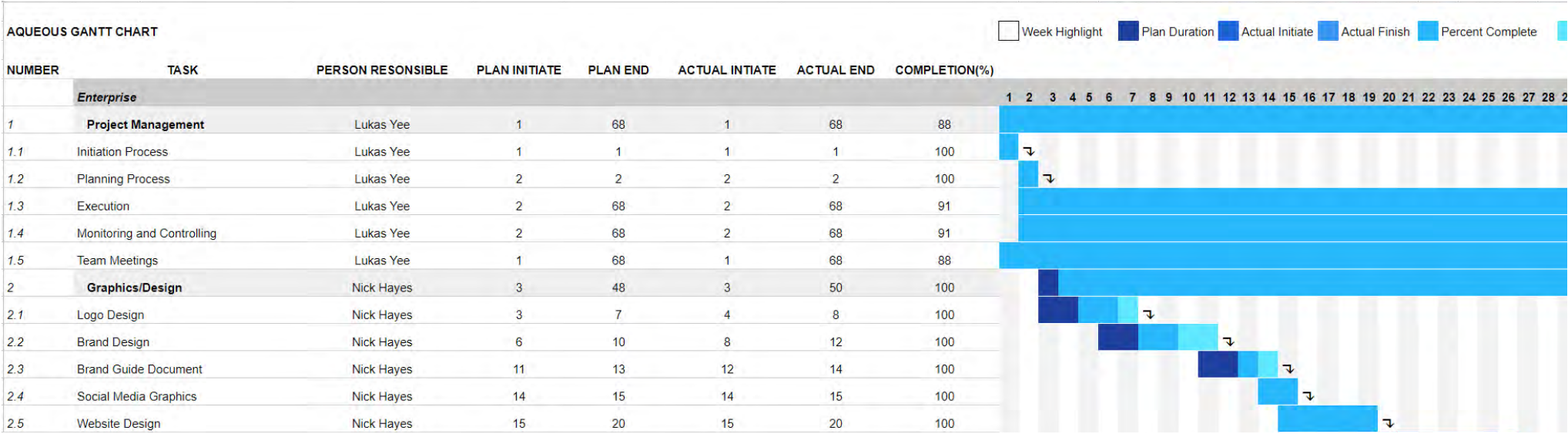
Necessary Resources

Aqueous understood that an effective project schedule also involved a detailed understanding of the resources necessary for project completion. Therefore we set deadlines for the acquisition of sponsorships, and physical and virtual resources as a component of our project schedule. Further details are available in the Enterprise Portfolio for examination.

Acceptance Criteria

Acceptance criteria are conditions that must be met in order for a task to be completed, and are essential to the completion of any project.

Aqueous understood the need to effectively define acceptance criteria for all deliverables, both physical and virtual. While it was much simpler to implement acceptance criteria for physical components of the competition, for example reaching scrutineering standards in the manufacturing process of the car, we recognised that we must consistently control quality throughout all aspects of our participation. In order to ensure that acceptance criteria were met, we incorporated a project management model in which team members shared all work for quality control and review through online platforms. Necessary changes and feedback were then communicated individually.

Upper: Figure 4 - Our team Gantt Chart   (source: team files)
Lower: Figure 5 - Our team Work Breakdown Structure

Figure 4 - Our team Gantt Chart

NUMBER	TASK	PERSON RESONSIBLE	PLAN INITIATE	PLAN END	ACTUAL INTIATE	ACTUAL END	COMPLETION(%)
	Enterprise						
1	**Project Management**	Lukas Yee	1	68	1	68	88
1.1	Initiation Process	Lukas Yee	1	1	1	1	100
1.2	Planning Process	Lukas Yee	2	2	2	2	100
1.3	Execution	Lukas Yee	2	68	2	68	91
1.4	Monitoring and Controlling	Lukas Yee	2	68	2	68	91
1.5	Team Meetings	Lukas Yee	1	68	1	68	88
2	**Graphics/Design**	Nick Hayes	3	48	3	50	100
2.1	Logo Design	Nick Hayes	3	7	4	8	100
2.2	Brand Design	Nick Hayes	6	10	8	12	100
2.3	Brand Guide Document	Nick Hayes	11	13	12	14	100
2.4	Social Media Graphics	Nick Hayes	14	15	14	15	100
2.5	Website Design	Nick Hayes	15	20	15	20	100

Figure 5 - Our team Work Breakdown Structure

Team Members

Lukas Yee
Team Manager
As team manager, Lukas was responsible for the completion of the whole project. He made sure tasks were completed on time in accordance with our timeline, maintained communication between all team members, and ensured everything was completed to a high standard. All project deliverables were signed off by Lukas to ensure there was recorded documentation of all team activities.

Nick Hayes
Brand Coordinator
Aqueous' Brand Coordinator, Nick, was responsible for our graphics, and maintaining a strong, consistent brand amongst all of our project elements. Through the use of digital design software, Nick was able to create graphics for all of our documentation, and products (ie, trade display, car, uniform), and create a strong social media presence.

Preston Zhang
Marketing & Resource Coordinator
Preston was in charge of our stakeholder interactions and management of our finances. He is responsible for reaching out to potential companies for sponsorship. Preston's job also included managing our budget, creating documentation, and completing additional duties that were of a smaller scale.

Harry Board
Design Engineer
As the design engineer, Harry designed and created our car on an online Computer Aided Design software called OnShape. He applied his 4 years of experience as an engineer in F1 in Schools to create our car. Harry worked with Charlie and Bill to get a car design that was as fast and efficient as possible.

Charlie Burgess
Testing Engineer
Charlie was in charge of testing the car Harry designed. Using Computational Fluid Dynamics, Charlie tested our car's aerodynamic ability to ensure it was the best design. He also incorporated physical testing to validate the car's virtual statistics, and to test a variety of designs in comparison to each other.

Bill Klein
Manufacturing Engineer
As our Manufacturing Engineer, Bill utilised his skills in CNC milling machines, 3D printers, and its subsequent use of Computer Aided Manufacturing to create our final car design. He was responsible for ensuring Harry and Charlie's car design was constructed as best as possible to minimise surface drag and the effects of a physical car.
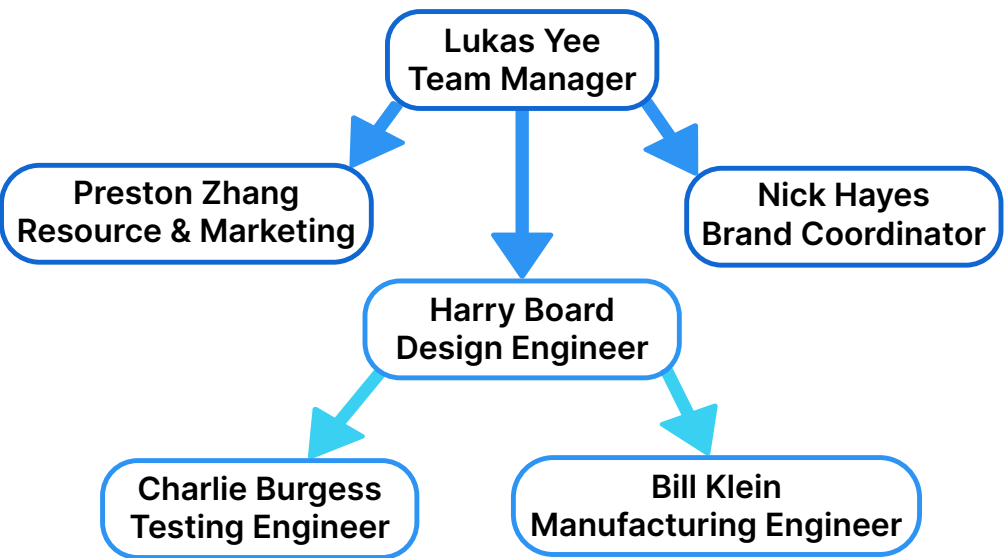

Figure 6 - A diagram of our primary team interactions based on our roles (source: team files)

Secondary Roles
In addition to primary roles, our team implemented a system of secondary responsibilities. A secondary role is an additional responsibility performed by a team member, which supports another team member's primary responsibility. In a team environment, it is crucial that team members are able to complete tasks that are not only associated with their role, in the very probable scenario of a large workload period, a team member in a leave of absence, or just to provide additional feedback on a specific deliverable.

These secondary roles also included our own system of Corresponding Collaborative Management. Because we are a collaboration team, effective communication is a necessity. To aid this, we assigned Harry and Charlie the secondary roles of our Corresponding Collaboration Managers (CCM), ensuring that everyone from both sides of the team was on the same page. They would both report to our team manager, Lukas, and both of the schools' supervising staff to keep everybody up to date on project deliverables and progress.

Supervisors
Brendan O'Keeffe and Colleen Scalone are the coordinators of the F1 in Schools program at Blue Mountains Grammar School and Newington College, respectively.
Colleen had only recently joined the program and has worked tirelessly to support our team and provide administrative aid.
Brendan has assisted our team throughout various stages of the competition, and in addition to administrative assistance, he has been an invaluable source of constructive criticism.

Team Structure
We had two departments within our core team, the enterprise department and the engineering department, each containing three core team members. The enterprise department consisted of Lukas, Nick, and Preston, which focused on project management, and marketing. Harry, Charlie, and Bill made up the engineering department, all of which were responsible for the design, testing, and manufacturing of the car (see fig. 7).

RACI Matrix
During the initiation phase of our team development, we constructed a RACI (Responsible, Accountable, Informed, Consulted) matrix to identify the key deliverables required for this project, and the team members responsible for these items.

Project Deliverables	Team Manager	Brand Coordinator	Marketing & Resource Coordinator	Design Engineer	Testing Engineer	Manufacturing Engineer
Car Design	C	I	I	R	R	A
Car Manufacture	I	C	I	A	R	R
Trade Display	C	R	A	A	I	I
Enterprise Portfolio	R	R	R	I	I	I
Engineering Portfolio	C	A	I	R	R	R
Project Management Portfolio	R	A	A	I	I	I
Verbal Presentation	R	R	R	R	R	R

Figure 7 - Our team RACI matrix (source: team files)

Introduction

As a collaboration team, we understood the significance of an effective and consistent communication plan, both internally and with stakeholders. Our team utilised various communication tools such as meetings, documents, phone calls, emails, instant messaging platforms, and several social media platforms, to ensure that our project was progressing.

Communication Tools

The main internal communication tool we used was the instant messaging platform called Discord. Because we are a collaboration team, there is large distance between the two schools which prohibits regular physical communication. This is why we implemented the use of online meetings, so we could interact regularly and maintain communication. The reason we chose Discord is that it offers a wide array of tools such as messaging services, individual and group calls, video conferencing, and screen sharing. In addition, Discord is a free-to-use application, making it easily accessible to all members of the team.

We also utilised a shared drive in order to have a centralised location for all of our documents, media, and any other files. This allowed everybody to have access to team files, allowing for fluidity between the production of various project deliverables, and influencing productivity. This shared drive also mitigated the risk of losing files on individual local drives, as everybody had online access to this drive which was backed up.

To communicate with non-team member stakeholders, we used emails, phone calls, and zoom video calls. These communication tools are fairly standard across all industries, allowing us to easily contact stakeholders and inform them of our progress, discuss sponsorships, or organise items.

Team Norms

As a collaboration team, our first priority was to get to know each other better, and create a cohesive team. Our team norms were established, and aimed to achieve a safe, productive, and positive work environment. These team norms were set out in our initial team meeting, where we discussed and agreed upon our commitment, team interactions, and responsibilities. The governing of our team norms allowed us to develop trust, one of the most important aspects of a team. Consequently, the initial development of team trust enabled us to be comfortable with disagreements and conflicts and be held accountable for our responsibilities. This allowed our team to have a strong focus and dedication to maintaining high standards.

Information	Method of Communication	Sender	Receiver	Timing of Issue
Meeting Minutes	Team shared drive	Team Manager	Team Members	Weekly (after meetings)
Status Report	Team shared drive, email	Team Manager	Supervisors/Team Members	Monthly
Project Communication	Discord, messages, email	Team Members	Team Members	As required
Sponsorship Prospectus	Email, physical prints	Marketing and Resource Manager	Potential sponsorship stakeholders	As required
Social Media Posts	Social Media (ie, Instagram, Facebook, website, TikTok, Discord)	Brand Coordinator	All (public)	As required
General Enquiries	Online website form	External (public)	Team Members	As required

Figure 8 - An excerpt from our communications matrix (source: team files)

Conflict Resolution

In a team environment, conflict is almost always going to occur. Especially in a collaboration team where many of the team members are unable to physically meet, conflict and miscommunication are bound to occur. Although through the use of communication tools, we mitigated many conflict situations, we believed it was necessary to implement a conflict resolution plan in the case that conflict arose.

Conflict is not something that should be neglected and disregarded, it is something that should be embraced and highlighted to work through, and find a solution to. Team members were encouraged to be respectful of everyone at all times, even in conflict situations. A third-party individual was to be present (ie, the team manager) in these situations where the people involved were to talk it through and clarify responsibilities (using the RACI table).

Stakeholders

Our team identified five types of stakeholders that were involved in our team's project. These included the team members, financial sponsors, resource/product sponsors, mentors (ie, advisors, industry collaborators, and teachers), and indirect stakeholders.

The indirect stakeholders of our project were not directly involved with our project, however, they were individuals and organisations that were involved in the broader competition. This group consisted of our In-Country Coordinator, Re-Engineering Australia Foundation, F1 in Schools, members of the public, and our two schools, Newington College and Blue Mountains Grammar School.

By identifying our stakeholders, we were able to provide the necessary communication involved to keep them informed of our project progress, and maintain our stakeholder interactions.

Figure 9 - An excerpt from our stakeholder register (source: team files)

Stakeholder Name	Stakeholder Group	Team Involvement	Contact	Relevant Team Contact
Leap Australia	Mentor	Mentorship	errol.hale@leapaust.com.au	Charlie Burgess
Bremick	Financial sponsor	Funding	matt@bremick.com.au	Preston Zhang, Bill Klein
Capral Aluminium	Resource sponsor	Resource funding	kate.sawaszenko@capral.com.au	Bill Klein
Keyshot	Resource sponsor	Resource funding	education@luxion.com	Harry Board, Nick Hayes
Maxident	Mentor/resource sponsor	Mentorship, resource funding	max@maxident.com.au	Harry Board
Objective 3D	Resource sponsor	Resource funding	parts@objective3d.com.au	Harry Board
Morgans	Financial sponsor	Funding	charles.johnston@morgans.com.au	Lukas Yee
Newington College	Indirect Stakeholder	Administration	cscalone@newington.nsw.edu.au	Lukas Yee
BMGS	Indirect Stakeholder	Administration	bokeeffe@bmgs.nsw.edu.au	Nick Hayes

Budget & Resource Management

The effective control and utilisation of available resources were critical in Aqueous' participation in the 2022 World Finals.

Due to international restrictions following the Covid-19 pandemic, it was necessary to respond to a reduced supply of resources, including physical materials caused by a reduction in global manufacturing and transport, in this competition. Therefore, our team developed a strong focus on budget and resource management, so that available support was utilised achieving the greatest organisational value.

Resources available to our team included monetary support, advice and experience provided by skilled mentors, materials, equipment for physical testing, and licences to CAD and speciality software. Aqueous' participation in the World Finals was funded by a network of sponsors and industry leaders developed over the course of the competition.

Funding & Resource Acquisition

Resources required for Aqueous' participation in the World Finals will be primarily acquired through sponsorships.

As per our Return on Investment plan, which is documented for assessment in the Enterprise portfolio, sponsors will provide the necessary raw materials for the manufacturing process, funding to cover both manufacturing and other miscellaneous expenses, software licences and equipment used to present necessary deliverables, in exchange for promotion of their brand to a demographic of young people involved in STEM.

Aqueous primarily focused on local sponsors, in particular local leaders in marketing and engineering, in response to restrictions on global travel and transport as a result of Covid-19.

Mentorship and experience in the competition were another valuable resource Aqueous recognised as key to our participation. These resources augmented the existing skills of team members. As a new team in the World Finals, advice provided through a support network of teachers, mentors and coaches was crucial and greatly benefitted our progress.

Our team recognised that all key resources, including equipment and licences for CAD software, must be acquired in the earliest stages of the competition, with all key sponsorships due by 20th April 2022 as per our project scope and Gantt chart.

Budget & Resource Control

The team budget was allocated for the purchase of necessary materials for the design and construction of the car, licences for appropriate software, the manufacturing process of the display booth, uniforms and other team equipment to maximise benefits to Aqueous' performance. The budget was controlled through rigorous monitoring over all stages of our participation. The following processes were core components of our team's budget and resource management.

1 - Creation of Estimated Budget

Before the design and manufacturing process, our team created an estimated budget based on the predicted market supply and value of certain resources, including travel and accommodation. This allowed us to effectively determine the number of funds required and identify relevant areas of expenditure. The projected budget also allowed Aqueous to evaluate target industries and areas for sponsorship.

Changing conditions and acquisition of sponsorship necessitated amendments to the budget. Our online registration due to the impact of the Covid-19 pandemic, for example, greatly reduced the costs of travel and accommodation. We created visual aids using tools like Excel which assisted in the control of resource distribution.

2 - Control Criteria

Before any purchase or usage of funding, our team evaluated the resource to be acquired based on a set of control criteria. Decisions regarding purchases were always made as a team, with the input of mentors and all team members. In order to correctly and consistently make these decisions, we created a system of criteria (see fig. 10).

3 - Allocation of Finance/Resource Managers

Due to the significance of resource management in a successful project, Aqueous identified key team members to oversee the effective acquisition and distribution of resources.

Preston, our Marketing and Resource Coordinator, was chiefly responsible for the allocation of resources throughout the team, and was also responsible for ensuring all project elements and deliverables were correctly resourced and financed such that they could be completed.

Bill, our Manufacturing Engineer, managed the distribution of finances in the manufacturing and engineering process. His detailed knowledge of the required materials and equipment made him ideal for this task.

1. Is the product necessary and useful?
2. Is the product included in our projected budget?
3. Does it exceed the budget and should the budget be amended?
4. Could a sponsorship be considered in this industry regarding the product?
5. Have all alternative products or providers been considered? Is this product of the greatest value?
6. Will the product be available immediately?
7. Has the application of the product been carefully evaluated and researched?
8. Could this purchase potentially benefit the future of our schools' STEM program?

Figure 10 - Control criteria (source: team files)

Date	Grouping	Description	Quantity	Cost (AUD)	Shipping (AUD)	Total (AUD)	Budgeted (AUD)	Variance (AUD)
15/7/21	Sponsor	Previous sponsors	1	$1300	$-	$1300	$1300	$-
25/10/21	Sponsor	Morgans	1	$1000	$-	$1000	$1000	$500
10/3/22	Sponsor	Bueno	1	$6000	$-	$6000	$5000	$1000
22/3/22	Sponsor	LEK	1	$5000	$-	$5000	$5000	$-
21/4/22	Sponsor	Donation	1	$1000	$-	$1000	$1000	$-
30/5/22	Sponsor	Klausen	1	$1500	$-	$1500	$1000	$500
8/6/22	Sponsor	Newington College	1	$1758.58	$-	$1758.58	$1000	$758.58
15/8/21	Marketing	Website Domain	1	-$160.85	$-	-$160.86	-$200	$39.14
3/3/22	Marketing	Giveaway Mouse	1	-$100	$-	-$100	$0	$-
27/5/22	Marketing	Uniforms	1	-$1154	-$40	-$1269.4	-$1200	$69.4
30/9/21	Car	Foam block	10	$-	$-	$-	$-	$-
29/1/22	Car	Tether guides	16	-$4.5	$0	-$72	$50	-$22
17/02/2022	Car	Hybrid Ceramic Bearir	24	-$36.65	-$210	$1548.6	$1500	$48.6
17/02/22	Car	Stainless Bearings	30	-$15.3	$-			
14/4/22	Car	Water Slide Decals	5	-$8	-$8.72	-$48.72	$50	$1.28
15/4/22	Car	Paint	6	-$12.45	$0	-$74.7	$100	$25.3
12/4/22	Car	Spackfilla	1	-$11.45	$0	-$11.45	$20	$8.55
15/4/22	Car	3D printing	50	$-	$-	$-	$-	$-
15/4/22	Car	Wheels	24	$-	$-	$-	$-	$-
29/4/22	Car	Other costs	-	$-	$-	-$30	$50	$20
3/6/22	Car	Shipping to UK	1	-$187.5	$-	-$187.5	$200	$12.5
10/6/22	Registration	Competition fees	1	-$3520.71	-$	-$3520.71	$14000	$10479.29
Balance						$ 10534.64		

Figure 11 - A snapshot of our team budget (source: team files)

Introduction

Aqueous established a rigorous monitoring and controlling system to ensure that all necessary deliverables were completed to the highest quality before the due date. In order to ensure that all team members worked to an effective schedule, several project management tools were used in order to monitor and control progress in the World Finals.

Status Reports

Regular status reports and meeting minutes were used to ensure that tasks were completed in a timely manner as per the scope and suggested schedule. These documents were made available to all members, mentors and coaches such that our progress could be communicated to administrative staff in addition to the team. These were also available on Google Drive, so that a team member who missed a meeting could still stay on track.

Meeting Minutes

For each team meeting, a meeting minutes was created. The use of meeting minutes was established at the formation of our collaboration team, to ensure a record of constant communication, and maintain accountability of responsibilities that were set out in our weekly team meetings. These documents recorded important decisions made in meetings, actions instigated and completed, team requests, and the discussion of ideas and important information. The meeting minutes of each meeting were uploaded to our shared google drive, where absent individuals could view them in order to stay up to date.

Mitigating Scope Creep

Scope creep, caused by unauthorized changes to the project scope, was a challenge faced by all participating teams responding to the changing conditions of the competition. Aqueous responded to scope creep through thorough communication. This was done over Discord, an online platform upon which all team members could communicate. Regular meetings were held to ensure that the necessary steps were taken to mitigate scope creep. Our procedure in managing scope creep is as follows:

1 - Team Consultation & Mentors

Our Team Manager Lukas is responsible for ensuring scope creep is minimised. This was done after consultation with mentors and the team. More members of the team may be allocated to a task that has been overrun to restore the project schedule.

2 - Scope Creep Evaluation

Team will decide whether changes to the project scope and Gantt chart are necessary during a meeting. This is based on an evaluation of the following criterion:
- Is the additional work necessary?
- Will this additional work enhance the project deliverables?
- Will this additional work delay or detriment future tasks?

3 - Communication with Stakeholders

Should the team decide that the task which caused scope creep would benefit deliverables, an email will be sent to relevant sponsors and stakeholders to inform them of a change.

Key Performance Indicators

Key performance indicators (KPIs) are used to assign a measurable value that illustrates how effective a team performing to achieve their objectives. There are two types of KPIs, high-level and low-level. High-level KPIs demonstrate the overall performance of a team, while low-level KPIs focus on individual performances. Our team implemented both high-level and low-level KPIs to monitor our performance and to make evaluations about team productivity. For example, a KPI of monthly funds raised ($) allowed us to measure the productivity of our marketing strategy (ie, sponsorship prospectus, contacting companies).

Performance Reviews

Our Team Manager, Lukas, implemented a system of quarterly performance reviews to assess each team member's work performance, provide constructive feedback, and set individual goals. This was used with KPIs to provide a constant evaluation within the team to allow for improvement, progress, and motivation, with assistance from mentors and teachers.

Risk Management

Participation in the F1 in Schools competition involved a range of risks. Aqueous carefully identified all potential hazards before commencing. All team members were made aware of any risks.

After careful consideration, Aqueous concluded that most of the risks were based in the design and manufacturing phase of the competition. In order to effectively communicate these risks in a concise, detailed manner, Aqueous created a Manufacturing Risk Assessment matrix that outlined the nature of each hazard and detailed prevention and mitigation procedures. Aqueous also was aware of the appropriate contacts in the event of an emergency or injury.

Figure 12 - An excerpt from our risk management table detailing the risks associated with manufacturing our cars and working in such an environment (source: team files)

Risk Description	Risk Severity Evaluation and Grade (1 = negligible, 10 = severe)	Likelihood of Risk (1 = unlikely, 10 = extreme)	Supervisor and Responsible Members	Potentially affected team members	Risk prevention	Hazard Response Protocol and Mitigation	Notes
Use of bandsaw could potentially cause severe injury	Significant damage potential and health risk. (7)	Extremely Unlikely (1)	Engineering team members. Authorised school and facility staff	Manufacturing team members.	Exercise caution when using bandsaw. Ensure appropriate safety precautions and training has been conducted.	Wrap injured area carefully and apply appropriate first aid treatment. Sterilize wound. Contact school nurse or ambulance.	Bandsaw only to be used with authorised supervision.
Inhalation of paint, sawdust or other fine airborne particles could cause damage to body	Moderate health risk. (4)	Unlikely (3)	Engineering team members. Authorised school and facility staff	Manufacturing team members	Wear appropriate PPE where necessary. Exercise caution when sanding or painting. Ensure that products meet suitable safety regulations and Australian legal certifications.	Ensure appropriate PPE is secured. Remove yourself or victim from the area and check for other immediate hazards. Ensure that particles are removed or cleaned appropriately.	All painting and sanding activities to be performed with extreme care and with PPE including safety glasses and masks.
Cluttered workspace could cause tripping hazard, entanglement in cords	Low health risk (2).	Unlikely (3)	All team members	All team members	Ensure that workspace is clear of potential hazards. Enforce normal safety precautions when working. Tidy up all workspaces after work completion.	Clear area. Check for significant injury. Apply first aid if necessary.	All team members responsible for ensuring that their work area is completely clean before and after working.
Electric drills and other power tools involve inherent risks	Moderate health risk (3).	Very Unlikely (2)	All team members	Manufacturing team members	Ensure that power ports are secure. Ensure that emergency power stop is ready for use at any time. Check equipment certification is appropriate as per Australian legal standards. Ensure that team member has appropriate training with tool.	Remove yourself or victim from area and check for other immediate hazards. Call ambulance if necessary.	All team members undergo necessary training with power tools before usage.
Use of milling machine can eject dust and particles at high speed, and the rotating blades are a hazard	Moderate health risk (5)	Unlikely (3)	Engineering team members. Authorised school and facility staff	Manufacturing team members	Exercise extreme caution and only use when under careful supervision. Wear appropriate PPE and check safety precautions and equipment integrity.	Clear area and turn off power or use emergency power stop if necessary. Apply appropriate first aid and call an ambulance.	Milling machine only used under careful supervision by mentor or school staff. No incidents occurred.