

SHEFFIELD FORMULA RACING

2022 February Issue



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Technical Update

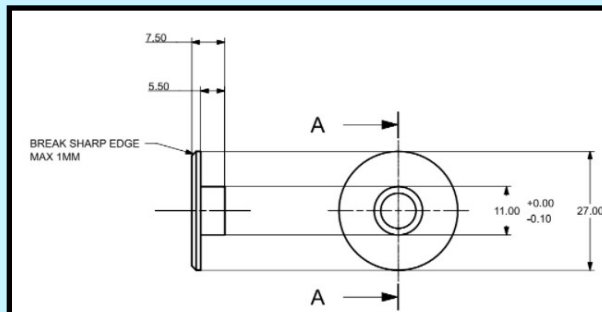
As the winter months end and the days begin to get longer it can only mean one thing: the run-up to the FSUK competition has begun!

All sub-teams are now adding the finishing touches to our CAD files, optimising structural components with computer software ready for manufacturing. To optimise we use Finite Element Analysis (FEA) techniques, which allow designers to see which areas are stressed and which are not. By reinforcing stressed areas and removing mass from unstressed areas we can reduce the weight of the component, and improve its structural efficiency.

For manufacture it is crucial to produce technical drawings, or as they're known in Hollywood "blueprints." These drawings are used to make the part: if done by hand then the dimensions are used during manufacture (e.g. 'turning' on a lathe); if a computer is used to make it, then they are used for validation after the part is made (e.g. using a CNC mill). It includes details such as: lengths, radii, diameters, angles, the material (and its grade), any post-processing treatments and images of what the finished product should look like.

As we begin to make parts, all eyes are focused on our first ever mono-coque chassis. Our moulds are in the process of being shaped using a CNC milling machine. We will then begin to lay sheets of pre-preg carbon fibre into the moulds to get our shape, as well as incorporating a protective, impact-absorbing 'sandwich layer' into it. Once preparation is complete, we place it into an autoclave (a big engineering oven), where the resin cures and hardens, creating a solid structure.

With the SFR manufacturing gears prepped and ready to turn, watch this space!



Equality, Diversity and Inclusions

Equality, diversity and inclusion (EDI) should be of huge importance to any team. For us at SFR it is a big part of who we are, especially since our primary goal is to supplement the education of our team members providing opportunities for them to gain engineering experience regardless of their background. Ensuring that everyone has equal access to this opportunity, and can gain from it equally, is essential to achieving that goal. We believe that all of our team members have amazing talent and unique skill sets, which we hope to fully foster and access regardless of their visible or invisible identities.

EDI is something that we actively strive towards, whether it be eliminating bias and protecting anonymity during our recruitment process, or ensuring that we have officers in place who are responsible for ensuring EDI is a part of everything we do. We think that this reflects the values of the University of Sheffield as a whole, and we actively work with them to improve our EDI policies like utilising outreach opportunities including advertising to first years through the universities 'Women in engineering' network as well as ensuring that everyone on the team feels welcome and that they can talk to our EDI officer if they are facing any issues.

We believe that our EDI measures have made our team a place where everyone can feel included and we are determined to continue to strive towards our goal.



Meet the 'Big 3'

In the SFR team structure there are 3 elected 'big names': the Team Principal, Technical Director and Manufacturing Director. Without these three, we wouldn't have a car, so in this issue let's meet them!

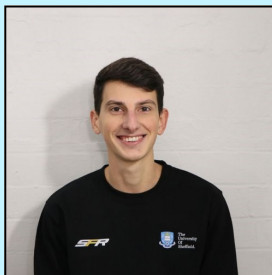
George - Team Principal

How long have you been on the team?

4th year actually on the team (+1 year in industry)

What parts of the car have you worked on/ designed previously?

In my first year in the team I worked on the track rods, in my second year I was designing the entire steering system and in my third year I was designing our novel inboard suspension system.



What does your role entail?

As Team Principal I am leading a group of around 50 engineers, overseeing and directing the full running of the entire team. It is my responsibility to manage the budget, to set high-level deadlines, to ensure all sub-teams adhere to them and to assist in dealing with any unforeseen circumstances. I am driving the team to perform to its very best and providing teaching and training to certify the team's strong future.

What did you do during your Year In Industry?

Last year I did my year in industry at Williams F1 in the department of mechanical design. I was analysing design briefs and thinking creatively for possible design solutions, using CAD software to create 3D models, generating engineering drawings of the parts and systems to be sent for manufacturing, assessing whether the design will work and its usability and safety and so much more.

Favourite SFR memory?

When we were back at the campsite after the end of the competition in my first year, and suddenly the complete results were announced putting our team for the first time in the top 5. The atmosphere was insane!

Richard - Technical Director

How long have you been on the team?

This is my 5th year on the team (+1 Year In Industry)

What parts of the car have you worked on/ designed previously?

In my first year, I designed a central locking wheel nut, and some chassis tabs. In second year, I designed the chassis, which was heavily optimised to have a high specific stiffness. I also designed the headrest. In third year, I led the aero team to develop a new aero package, I re-designed the front wing mounts and side wing mounting. Unfortunately, due to the pandemic these were never manufactured.



What does your role entail?

I am responsible for overseeing the development of the entire car. This has involved identifying new routes of development, and scheming concepts for sub teams to take forward and develop. I also work closely with sub team leaders and our head of structures to ensure the parts we design are safe.

What did you do during your Year In Industry?

I did a vehicle design student placement at Red Bull Racing, designing parts for their RB16, RB16B and RB18 F1 cars. Specifically, I worked in the Engine Systems department, who design the cooling system, exhaust system, fuel system, auxiliary PU performance systems and various electrical installations. My role varied from designing solutions to fix car faults, designing jigs and moulds, designing R&D and Aero test rigs. I also helped the composite department, designing front wing flaps, strakes and metalwork.

Favourite SFR memory?

It's difficult to choose a favourite, I think there are two that stand out. Firstly, coming 5th at FSUK in 2018, which was our best achievement at the time. Secondly, the whole weekend of the 2019 competition – it was a bit of a rollercoaster, and very bittersweet. We had a very quick car and we were looking odds on to finish in the top 3. We fell short in the endurance event and never quite got rewarded for all the hard work which was put in that year – some good life lessons learnt.



Meet the 'Big 3'

James - Manufacturing Director

How long have you been on the team?
This year is my third year in SFR and at the University.

What parts of the car have you worked on/ designed previously?

In the past, I've been primarily working on vehicle dynamics in both design and simulation. In my first year, I designed the front and rear track rods for SFR11. In my second year, I spent most of my time working on the team built quasi-steady-state lap simulator. I investigated the effect of vehicle parameters such as: brake bias, weight distribution and aerodynamic downforce.



What does your role entail?

I'm working alongside Team Principal George and Technical Director Richard to shape the 2021/22 SFR team. My primary responsibilities include manufacturing organisation, decision making and the sourcing of materials and facilities. I spend most days talking to our many supporters discussing their manufacturing capabilities, and ensuring our manufacturing timeline is on track.

Any plans for a year in industry?

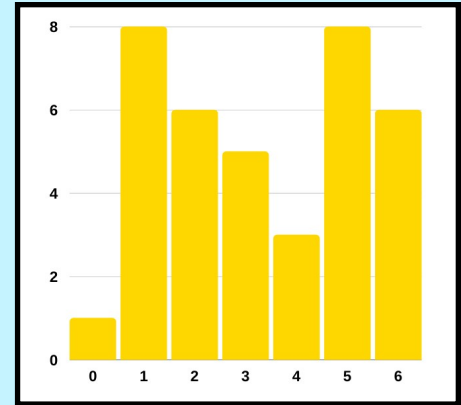
Next year I plan to take a year away from academic study and secure a placement. I'm currently mid application for a selection of year long industrial placements, most of which focusing on manufacturing technology.

Favourite SFR memory?

I've only just come down from the thrill of the 2021 FSUK competition. Last year, the team faced many challenges and hardships, and to see our dedication and preservation pay off was a great feeling. One of my favourite team memories is working in our workshop lab late at night over the summer. The lab was full of team members working together into the early hours of the morning. We were all so invested in the car, and determined to get the car race-ready. I had never seen a group of people with such high team morale at 2 am.

Christmas in Numbers

How many exams did you have?



Where did you spend Christmas?



What language is spoken at home?



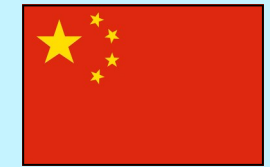
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SFR Outreach

Last December, SFR team members visited UTC Sheffield - a local technical college who reached out to us thanks to our 2021 competition success. They have three teams developing cars for Green Power competitions - two for 'Formula 24' (F24) and one for 'Formula 24 Plus' (F24+). We're working with them to share our expertise in organisation, planning, design and sponsorship. The team think it's fantastic to share our knowledge and passion in our local community, as well as hopefully inspire the students aged 13-16 to continue developing their interest in engineering.

The F24 competition involves taking a frame and other standard components given to competitors and travelling the most distance in a set time. This can be done through aerodynamics, reducing friction in parts, adjusting gearing systems and keeping the motor running cool to get the most out of the singular battery available. The F24+ competition, that the older students take part in, involves designing all parts for their car. This increases the freedom the students have in the design, but they must meet a strict set of rules and regulations set out by the officials, just as we do in the Formula Student competition.

We first delivered a presentation to UTC, teaching them how we: develop a team structure; plan for the year using a 'top down' approach; design parts for the car; and find/approach sponsors. The F24+ team greatly appreciated this information as this is the first car they're developing - a daunting challenge. To our delight, as soon as the presentation ended, we saw the students pull their laptops out and create a team structure spreadsheet - just as we had advised!

After the presentation, we then spoke individually to the three teams, discussing and helping them with any design, manufacture and testing queries. It was interesting to see their SOLIDWORKS CAD chassis design, and the prototype chassis tube connectors they had manufactured using both aluminium casting and milling. We were also very impressed by how comfortable they were using tools ranging from drills, to welding and even CNC milling machines.

We introduced the F24+ team to 'Finite Element Analysis' (FEA) techniques, helping them to validate their designs with computer software, without manufacturing prototypes. Some general considerations for their chassis design were also suggested, for example trying to incorporate triangles where possible to increase stiffness. The younger teams were busy testing their cars' drive systems, so we helped prepare their cars for safe testing and watched the motors spin up. We taught them about using jigs to align components and in their case, to make sure their front wheels are parallel.

We hope the students learnt some valuable skills, so they can continue to develop their cars ready for competitions in the future. We think it's great that students are involved in such hands-on engineering projects from such a young age, and we hope they will use skills learnt from this in future engineering degrees, apprenticeships and careers. We hope to visit again soon to check on their progress, and also welcome them into our lab to see our car and how we build it. Hopefully we'll even see some of them become future SFR recruits!





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