



# Team Newsletter

September 2021





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## Team Leader Keith Anderson



Keith

Just a couple weeks ago the workshop was packed with members both new and old working day and night to get the 2021 car completed. It's always mind-blowing when we sit down and try to ballpark the number of hours that go into the team each year, and truly humbling to see what a small fraction each member contributes individually.

This year's recruitment was our largest yet, with the most applications received, interviews and projects given, and new members brought on. The expansion comes from the team's desire to grow in scope and to share the awesome experience that is Formula SAE with as many people as possible. We were also impressed as ever with the quality of the applicants this year - I'm not sure I would have been able to land a spot on the team with this kind of competition!

A large part of FSAE's value to our members is the opportunity to work in a large, diverse, multi-disciplinary team; so we've also put particular emphasis of growing our membership across the University. This year a special focus was put on our business team which has more than doubled in size under the excellent leadership of Priya Prasad. I know they are working on some really exciting projects to be unveiled over the coming months.

Each year the team heads over to the Australasian branch of the international Formula SAE Competition; going head to head with universities from around the world. The competition last year was cancelled which gave us the unique opportunity to take part in a NZ-based mock-competition down in Cromwell with the University of Canterbury Motorsports Team.

Competition is a key part of the FSAE experience, and is the ultimate test of the car that a team builds, as well as a test of the character of the team itself. Stay up-to-date with us on social media to see what competition is going to look like for us this year.

We wouldn't be in a position where we are able to develop and grow as a team if it wasn't for the continued dedicated support of our sponsors. This team means the world to its members and has immense value for all of us. Every one of us are grateful for all that each of you do. Thank you.

With the world slowly returning to normal, the team has been following suit with our first new car since 2019, and with it our first chance to return to a more usual manufacture and testing cycle. Since the start of the year, the team has been working as hard as ever to get the M021 built. On the 17th of July, our efforts were rewarded with one of the earliest running cars the team has seen in years!

Overall, our goal for the M021 was to create a reliable, adjustable and tuneable platform that we can use to maximise performance over a longer on-track testing campaign. While the package is broadly similar to the M019, we have made a number of updates to improve tuneability and serviceability.

The M021 features a similar 4WD electric drivetrain package to the M019, sporting the same 33kW motors which provide over 1000Nm of total torque at the wheel. The powertrain team spent the early months of the year working with the M019 to increase the reliability of the motor package. Prior to transplanting the powertrain into the M021, we managed to make large improvements to the maximum speed and torque the car can run reliably, which leads to much faster acceleration, and lower lap times.

To improve the tunability of the car, we have re-worked our suspension system to include push-rod shocks, and anti-roll bars at the front and rear. This gives us the freedom to learn to adjust and tune the car for maximum performance. Simultaneously, we are saving weight in the suspension with an all-new carbon fibre wishbone design. As far as serviceability is concerned, it was always a huge effort to remove, charge, and re-install the accumulator battery pack of the M019. For the M021, we have re-designed the chassis so that we can remove the accumulator from the rear of the car. This turns a 6-person, 20-minute job into a 2-person, 5-minute job, saving time during testing sessions. These major changes, alongside a number of minor iterations, help the M021 become a tuneable, serviceable car with which we can be at the track, testing as much as possible.

Next up for the team is to finish the manufacture of the aerodynamics package, including a front and rear wing, as well as a downforce-producing undertray. which has seen a number of performance updates for this year, and promises to keep the car glued to the road for maximum cornering performance. Alongside this, there are a number of projects in the works to deliver updated components to replace parts of the car for further performance gain. For now however, we are getting stuck into the start of our on-track testing campaign, learning about how the car runs, how the drivers perform, and what we can do to improve both!

It is very exciting for us to be seeing a car running this early in the year, and inspires us to keep working hard to maximise the performance before competition. While the team may not be able to control the pandemic, we are certainly able to make the most of the time we have at the workshop to keep progressing and improving the car. Although we are currently looking to attend competition in Australia at the end of the year, travel restrictions may keep us to once again competing to be the best of this side of the ditch. However the COVID situation plays out, we are determined to field a fast car no matter where we are, and we are in a positive place at this point in the year to be able to do so!

## Chief Engineer Joshua Hares



# Meet the New Members of 2021 Management



**Chief  
Engineer**

Josh Hares

PhD in Mechanical  
Engineering



**Driveline  
Leader**

Bowen Xiang

Bachelor of Engineering  
(Hons) – 2<sup>nd</sup> Year Software



**Suspension  
Leader**

Beau Carner

Bachelor of Engineering  
(Hons) – 3<sup>rd</sup> Year  
Mechatronics

# Meet the New Recruits!

We talked to some of our 2021 New Recruits and asked them about their experiences on the team so far, their favourite parts of the car, and their experience on being on the FSAE team.



## Joshua Browne *Electrons Team*

I am a 1<sup>st</sup> year, completing a Bachelor of Engineering. I'm part of the Electrons sub-group. I've loved being on the team so far, it is fantastic being around like-minded people and you feel instantly accepted and acknowledged. The time you spend working for the team improves my skills and abilities.

I'm most excited about the automation possibilities i.e. having a driver-less car. By setting goals and bounds around what you are doing allows you to balance everything, I personally think this is the best time of your life to put everything into learning. You will never get these opportunities again.

## Jasmine De Mel *Marketing Team*

I am 3<sup>rd</sup> year, completing a Bachelor of Commerce, Majoring in Marketing. I'm part of the marketing team.

My time on the team so far has been very exciting and I have learnt a lot from others on the team. The skills I have gained from being on the team are invaluable to my future career after I finish university. I also have met so many new and like-minded people, who I would have never met without joining the team, so that has been a very positive aspect of joining the team.

Since I joined the team this year Covid-19 certainly has interrupted most people's lives, but since I'm part of the marketing team, we're still able to complete our work that needs to be done which is a great way to get through lockdowns.

## Phoebe Donaldson *Composites Team*

I am a 1<sup>st</sup> year, completing a Bachelor of Engineering and Science conjoint. I'm part of the composites sub-group. My experience on the team has been good, everyone is super welcoming. Being on the team has positively impacted my university life - it's a chill place to just go and learn after university and no pressure with it so far. I'm not all too up with the specs of the car but to be honest just a nice finish on the carbon is a good feeling and looks cool..

## Kenny Yu *Composites Team*

I am a 1<sup>st</sup> year, I am completing a Bachelor of Engineering. I'm part of the composites subgroup. While I don't fully know the workings of the car, it's been awesome to learn and work on making composites.

I've had a really great time working with other team members and being part of a team to create an actual engineering product is incredibly exciting. FSAE has been positive for me as I have got to meet and work with new people, but it can take a lot of hours out of your week. I'm most excited about the aero package as I'm really interested in aerodynamics and because it's what newbies have been working on for composites. Plus, it just completes the look of the car and looks sick.

Liam Kelly  
*Composites Team*

I am a 3rd year, I am completing a Bachelor of Engineering, specialising in Mechatronics. I'm part of the Composites sub-group. My time on the team so far has been busy, but rewarding. There is always work to do, and you can take on as much or as little of it as you like as long as you're willing to put yourself out there. Team members are always good to ask for university advice and Newmarket campus has excellent study spaces.

On the car I am probably excited most by the aerodynamics package. I've been involved in the manufacturing process so far and it'll definitely be rewarding to get the rest of the work done once lockdown finishes and see it all installed on the car. University and FSAE are definitely both significant time commitments but luckily they are also both very flexible, usually. You end up figuring out how to fit things together so that everything that needs doing gets done, but I think FSAE does push you to improve your time management somewhat (even if it's not a conscious effort to do so). COVID has been fine for me, since I just end up with a lot more time to focus on university while the workshop is closed during lockdown. In terms of motivation, I've found that the best motivator is having something in your to-do list that needs doing; you do need to put yourself out there and ask for work sometimes as a newbie. Of course, the second-best motivator is joining a subgroup you're interested in!

Matthew Inglis  
*Suspension Team*

I am a 2nd Year, I am completing a Bachelors of Engineering, specialising in Mechanical Engineering. I'm part of the Suspension sub-group. My time on the team so far has been fantastic. I really enjoy the manual machining. There's something satisfying about producing something with such precision with my hands. I've also had the chance to work on a small design task focused around redesigning the throttle pedal. This has really shown me the inner workings on the team and allowed me to get to know some of the other sub-groups and even a few sponsors.

It's been a challenge balancing my time, but with some planning it's perfectly manageable, and certainly worth it. Having only just joined the team I may not have the same appreciation for the advances the M021 brought as some of the more long standing members, however from what I've seen it's an excellent platform and I can't wait to see how the M022 develops on this. I was fortunate enough to join the team before lockdown. This meant I had the chance to work hands on with the car and learn the manual machining processes. The timing of the lockdown was somewhat fortunate as most of the team is moving towards the 2022 design campaign which I'm sure is a lot easier to do from home.





Events



# Tech Night 2021

The team hosted its annual tech night on the 14th of April, earlier than usual tech nights as we couldn't wait to show our progress to our sponsors, friends and family! Overall, this tech night went very smoothly from planning to the end of the night thanks to experience gained from previous tech nights in organizing catering and sending invitations. Team leader Keith, marketing manager Priya and chief engineer Josh all gave their updates and plans for the 2021 campaign. Faculty advisor Tom Allen also spoke to show his support for the team. A common theme through these speeches was the goal of making the M021 car as early as possible, and earlier than usual. This way, the team could be awarded milestone prizes while maximizing our testing time, which was proven to be a crucial step in making a title winning car.



Visitors were very intrigued by each of the workshop rooms and asked many thought provoking questions. Furthermore, some guests were not shy at all to give it a go on the team's racing simulator and generated some competitive times, while the catered food was demolished rather quickly! Alumni gave current team members tips and solutions to some aspects on the current design. UoA FSAE thanks all of those who came to this tech night and hoped that it was a fun evening!

# eWorld Expo

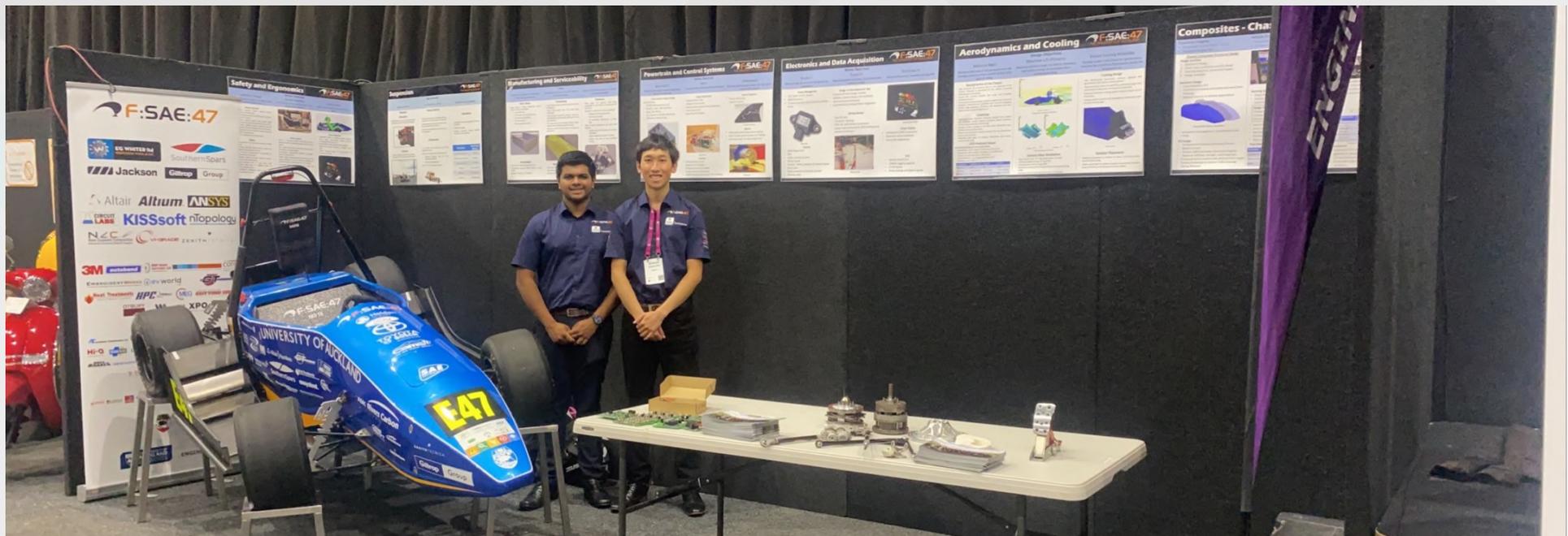
The UoA FSAE team was once again invited to the eWorld expo, which was hosted between the 6<sup>th</sup> to the 8<sup>th</sup> of May 2021. The eWorld expo is New Zealand's only event which showcases electric vehicles, bikes and scooters and their respective charging technology. The team attended the trade expo for members of the industry and intrigued enthusiasts, and the public expo for people of all backgrounds. From this event, the team expands their knowledge on electric vehicles, which they can use on the design of their car, while getting exposure NZ's electric vehicle market. The team would like to thank eWorld for their many years of sponsoring the team by putting aside a booth for the team to display their car in; furthermore, the team is extremely grateful to have received an extra booth's worth of space this year so we could display more information posters. With both the team leader and marketing manager facing busy schedules leading up to the event, the team was quite pressured on time in the organisation of this event. This did not deter the team to go onto having a smooth time at the expo.

During the trade expo, team members who were present at the stand were blessed with members of the industry coming up and spreading their knowledge and experience working in their respective fields. From customized Nissan leaf-engined

Land rovers, to conversations on electrical theory, team members were learning about many skills and lessons not taught in university. Many industry members also approached and offered possibilities of supporting the team, which the team was very grateful for. It was very exciting to see just how many EV experts were interested in seeing what our team does and what we aim to achieve.

The public expo day was much busier for team members manning the stand, with the venue packed and people of all backgrounds and ages were intrigued to seeing the team's work. Questions were raised from asking about how certain parts of the car worked, to how our team functions and how one can join the team. It was certainly exciting to project ourselves to the wider community!

This has again been a great event, especially with the challenges of travel restrictions and other limitations, and UoA FSAE greatly appreciates the eWorld and Conferenz team for their many years of helping out the team.



# Automania

Automania is a one day event that celebrates motor vehicles of all sorts, ranging from exotic muscle cars, heavily customised street racers, vintage to motorcycles. The show also makes use of Eventfinda Stadium's massive car park to showcase some D1NZ drifting and motorbike stunt riding, along with a quick run by FSAE's M014 car.

From set up, team members present were greeted with symphonies of various automobile engines, something that continued throughout set up and event day. Other displayers were quite intrigued by what we do and came over for a look during set up; likewise, team members went around checking out and asked questions about cars and motorbikes they were interested in. We were very proud to say that our car had the fastest straight-line acceleration out of all the vehicles there! Interesting conversations were also held with members of the public, with some expressing interests in joining the team and getting to know what the team does.

The stunt and drift shows were perhaps the highlight of the day and was great fun for all people at the venue. FSAE was first up into the spotlight, with Claude Griffith taking the M014's wheel and pulled off some daring manoeuvres, including small drifts at some points – this kind of behaviour is not usually allowed in a FSAE car but Automania is one exception! The MC gave a very exciting introduction to the team, and race engineer Justin gave a more in-depth technical overview of the car. In total, there were three different shows and thus the M014 was driven three times throughout the day. Team members were very pleased with the performance of our car, and enjoyed the Kawasaki Ninja 636 motorcycle performing wheelies and burnouts along with D1NZ drift cars who drifted together in very close proximity – generated huge clouds of smoke!

The team was very fortunate to be approached by organizers of Automania who offered us a place at this awesome event while the team was on display at eWorld. This has been a great opportunity to connect with the automobile community in NZ, where much mutual learning took place. UoA FSAE would like to thank organizers of Automania for organizing and inviting us to this event; we hope for similar opportunities in the near future.





M021 Manufacture



# Manufacture of the M021 Chassis

Monocoque manufacture started as in the traditional composites process with the making of moulds from precision CNC machined MDF plugs, generously provided by Jacksons Industries. This would be the first stage to define the chassis' geometry as our design team had envisioned it.

Our composites team prepped, sealed and coated the plugs in duratec. From there mould manufacture could begin. This would start with the application of high temperature tooling gelcoat compound followed by the layup of dry carbon fibres sponsored by Dean from NZ Composites Ltd. The laid up fibres underwent the resin infusion process and following a few touchups we were ready to start the chassis' manufacture!



Our team began the lamination of the sandwich type monocoque itself using high performance prepreg carbon fibres, supplied by Southern Spars. This would form the backbone of the lamination experience for many of our newer members who had never laid up a monocoque before! We first laid up our outer skin, followed by aluminium honeycomb core, followed by the inner skin. This year saw the implementation of a new core splicing product which, like many of our resin compounds, was supplied by our sponsor Adhesive Technologies. We found this to be extremely useful in permanently securing and binding core pieces together throughout the rest of the manufacture process. Each layup stage would be concluded by a cure in Innovate Composites' autoclave, large enough to cure the entire chassis!

In the midst of monocoque manufacture, our composites team have also been hard at work manufacturing all the other miscellaneous composite components that make up our car (there are a lot!). These include our custom designed carbon fibre steering wheel, manufactured with a two-piece mold and including an integrated LED display for driver feedback. Many of these parts required smaller scale autoclave cooks that were generously accommodated by our friends at Compotool Ltd.





In the last few weeks, with most of our composites components finished, we progressed onto welding up our main roll hoop, with some really nice mandrel bent tube section and laser cut parts provided by our sponsor Autobend Limited. We had some great collaborative input on this from both alumni and current team members, even though this ended up cutting it close for time.

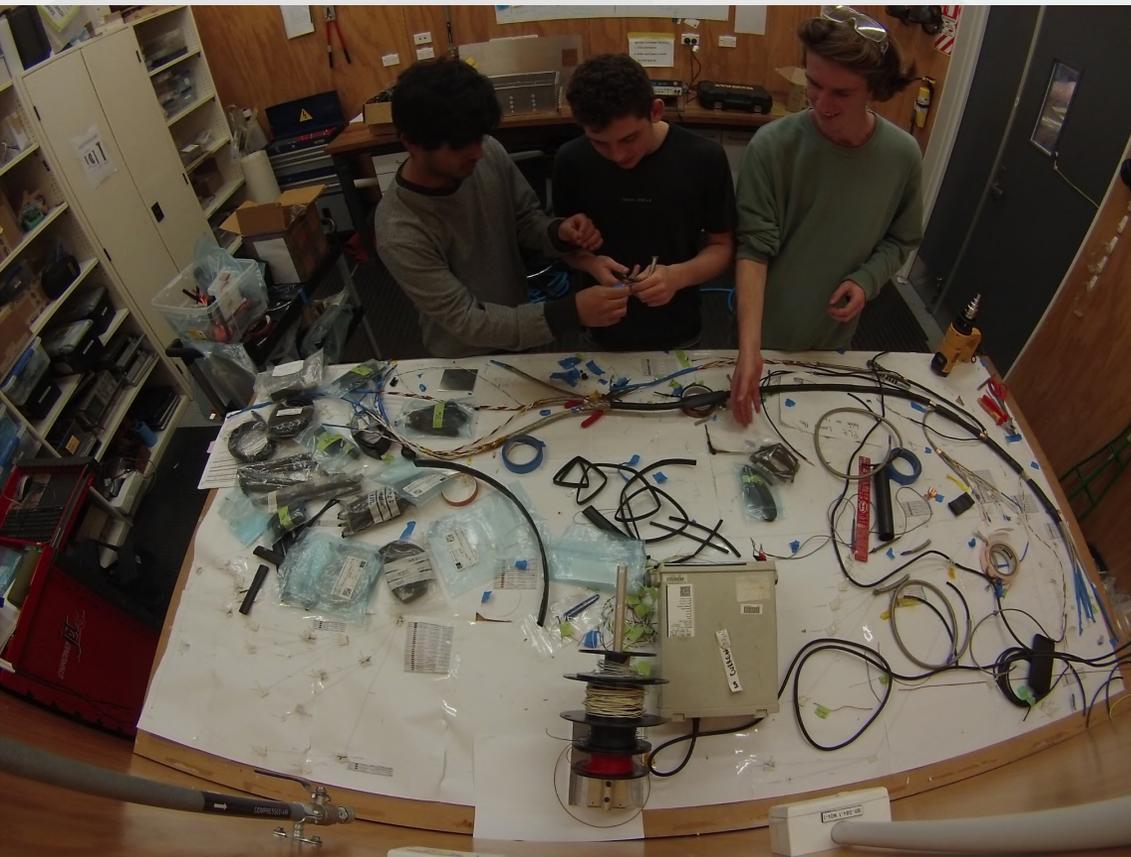
The end of chassis manufacture has also seen the composites team switch focus to the manufacture of our aerodynamics package. With moulds and facilities once again provided by Jackson Industries and the University of Auckland Technical Services Workshop we have been hard at work preparing the various tooling for manufacture. As of now we are chugging along nicely manufacturing 2D elements for the package. This is a great way to introduce our newbies to laminating an aerodynamics package before shortly moving on to the more complex geometries of an undertray or in-wash endplate.

These components are very close on the horizon and we hope to be able to share more of them with you soon!



## Electrical

The Electrical team have been hard at working putting together the many electrical systems on the M021. The complex wiring harness, made up of hundreds of wires, crimps and connectors has been fully assembled, shielded and insulated. The various boards required to run the car have all been manufactured and fully soldered with components.



For our new chassis with rear installation of the powertrain battery, all of the cells had to be moved across to a new enclosure with different mounting hardware. The correct assembly of the high voltage battery is safety critical, as well as tightly controlled by competition rules, so it was a meticulous process involving huge amounts of insulating Nomex and foam. We want to give a huge thank you to our many electrical sponsors. Without their extensive expertise and quality products we would not be able to achieve everything that we do each year.

# Suspension

As we wrap up manufacture for the 2021 campaign, it is important to acknowledge all the hard work that has gone into our suspension and driveline subsystems. Since polishing off design earlier this year, the suspension team's primary focus has been the manufacture of all mechanical components currently mounted on the M021. Some projects of note include the fabrication of a new set of light-weight carbon control arms and a steering system overhaul. Additionally, our senior members have been busily teaching the fundamentals of machining, in a bid to upskill our latest recruitment intake.





# M021 Testing



With the car assembled and ready to go, we have been able to get on with one of the most important parts of our campaign. Being able to test the car is the reason why all my colleagues have worked so hard to get it done this early on in the year. On the 19th of June, we completed the first run of the M021, one of the earliest running cars in the team's history. Having the running car so early enabled us to troubleshoot a few issues which we were able to fix before our first endurance attempt.

Less than a month later, on Thursday 12th of August, we travelled to Ardmore Airport to have our first full testing session with the new car. The session was run as a mock endurance, with Alex Barbarich-Bacher driving first and Claude Griffith driving after. Neither driver set out to break any speed records, as I had told them to "bring the car home" but they still impressed me with their consistency and control. Alex successfully completed the first half of the endurance, and while Claude was getting ready, we did a once-over on the car just to make sure there was no glaring issues. Claude then went out and completed the second half of the run, the two of them completing just over 22km together. I'd say that everyone at the track mainly felt both relief and elation when we crossed the finish line at the end of the last lap.

Unfortunately, less than a week after we finished the endurance we entered the current lockdown. While it is unfortunate that we have been stopped in our tracks just as we were getting started with our testing campaign, I know that once we make it through the current lockdown, myself and the rest of the team will jump straight back into testing.





# ENGINEERING



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