

Australian Adventure Special: Three challenging weeks down under!

The start of a New Year sees the Warwick Racing team reunited with their Australian counterparts, exhausted following three eventful weeks half way across the world. Furthermore, with last month's final CAD deadline successfully achieved, the team are eager to make good manufacturing progress and a keen start on our WR4 race car.

This month both the chassis and powertrain teams have been working hard to make up for the winter break in pursuit of a fully running car before Easter. Manufacturing is in full swing and WR4 is beginning to take shape with individual parts arriving thick and fast. January also presents the team with a number of new challenges, with the wheels set in motion for testing, competition logistics and our annual launch event this summer.



Spaceframe Build

December saw the chassis team make the first significant steps towards the manufacture of WR4, notching and tacking the individual tubular members of the spaceframe. With a sizeable portion of the team's winter break scarified, spirits remained high as the team became naturally attached to their beloved notching machine 'Velma' and the arrival of a brand new welding tent courtesy of WMG. The days were long and the Christmas hits playlist even longer, but the team powered through to get to grips with their new measuring equipment and their beloved 'Velma' in no time. With Alex Bending spearheading the momentous build, the team successfully pulled together to complete the task in record timing, two months ahead of last year in just seven days.

A special mention should be extended to **David Cooper**, **Darren Stewardson**, **Darren Grant** and **Zac Parkinson** for all their technical expertise and invaluable time over the festive period.



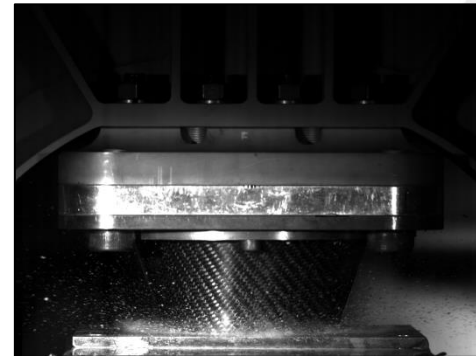
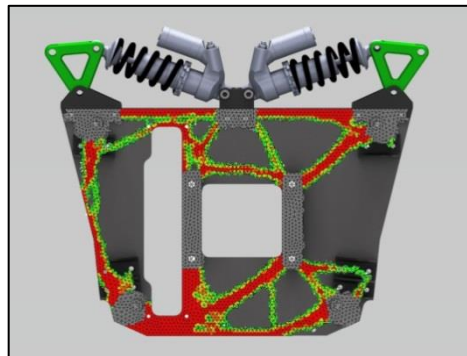
Chassis

From December through into January, the Chassis team has moved from initial paper designs to building the bones of WR4. With the prospect of Christmas on the cards and terrible sing-alongs to Christmas hits in our workshop, the whole team gave up their winter break to stay behind and work on the space-frame. As such, a vast majority of the spaceframe has now taken shape with only a few final touches to be made in the coming weeks. A special thanks must go to Tom from Tube-Bender Ltd for bending our roll-hoops in double quick time!

The removable rear bulkhead (affectionately nicknamed "Elmer") has now undergone its final few design iterations and is currently being machined along with supporting mounts and brackets. Two variations will be produced; a 'heavyweight' solid plate that will be used for testing and safeguarding against failures and then a 'lightweight' version that has undergone topology optimisation for maximum weight-loss. We are particularly grateful to GRM Consulting for aiding us in our first venture into topology optimisation.

Our composite seat design is now fully finalised and we look forward to working closely with one of our major sponsors, KS Composites, who will be manufacturing this for us in the coming weeks. KS Composites will also be kindly assisting us in manufacturing our innovative nosecone crash-structure, with the dynamic testing phase for our scaled nosecones now complete and full-scale crash testing underway. We are also extremely grateful to one of our most prominent sponsors SHD, for providing us with a vast quantity of carbon based pre-preg material.

Other aspects of WR4 have also been brought up to speed, with validation and optimisation of the suspension and steering systems resulting in a complete revamp of last year's design. The front hubs have also been redesigned to combat fatigue failure problems and a new bodywork design is now under consideration.



Powertrain

Over the past few months, the team has been pushing to deliver full CAD of WR4's powertrain systems, whilst taking the time to ensure that all components and materials are ordered. Hopefully the progress we have made will allow us to meet this term's key deadline – to manufacture a fully running race car before the Easter break.

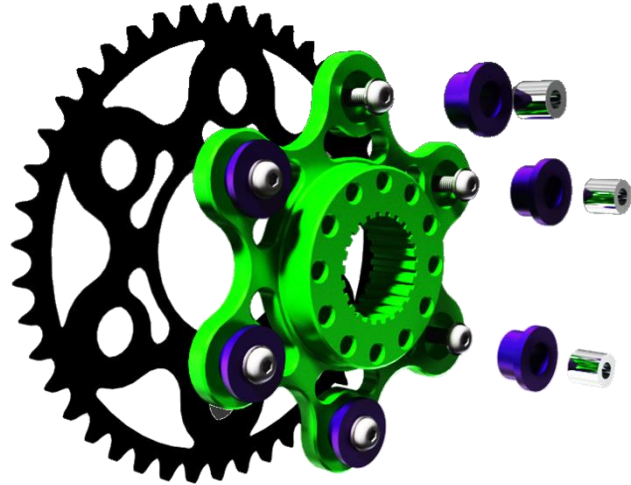
The vehicle's intake system has been designed and is awaiting manufacture. A variety of plenum lengths are to be produced and then validated on an engine dynamometer. This will allow the team to optimise the engine performance against the application of an SAE regulation restrictor.

Additionally, a number of essential parts have been sent to LaserProcess for laser-



cutting. This includes the fuel tank baffles, a new feature for this year's car, which will help alleviate problems with fuel surge.

Overall, WR4's drivetrain has really progressed since November. Output flanges are now complete, tripod bearings have been ordered and the half-shafts should be ordered in the next few days. The innovative anti-shock sprocket system, mentioned in the November 2013 Edition of our newsletter, is also progressing nicely, with machining of its respective carrier already scheduled and the manufacture of specialist bushes well underway by Powerflex. This 'cush drive' sprocket carrier solution aims at reducing shock loads through the drive chain, resulting in optimisation of downstream drive chain components for smaller loads. The sprocket carrier design pictured utilises flexible bushes and is specifically form optimised for the torque loads of our engine. In the coming month the Powertrain team hope to test and finalise the WR4 drive system, striving to integrate it into the vehicle's chassis!

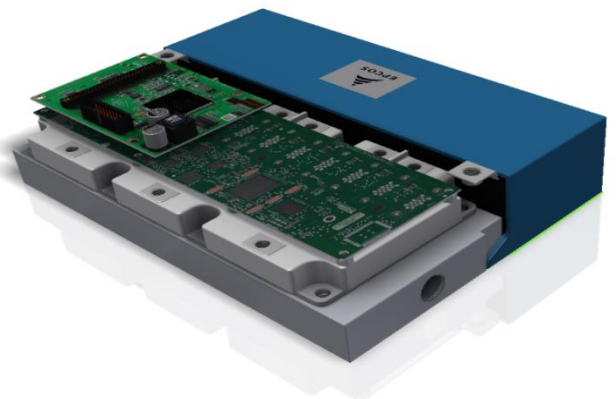


Electric

Since our last update, we have almost finished modelling all the major components for our vehicle in CAD, including the motor, batteries, inverter, motor controller and space-frame. Preparations for motor testing on the dynamometer are well underway, finalisation of our respective electrical specifications and system modelling using Simulink software progressing rapidly.

A 24-series 1-parallel battery module configuration by EnerDel has now been selected, as this can be directly mounted onto the vehicle and minimises the weight and volume occupied by the battery pack. Optimisation of the battery management system and cooling arrangements are now under way, to ensure compliance, safety and reliability.

We encountered some procurement issues at the beginning of January, but these have now been resolved, with little impact on the timeline of our project. Furthermore, in order to increase awareness of Warwick Racing's Electric project within the Engineering community we also produced a large poster to display in the department's common room, which proved to be a great success with fellow students.



Australian Adventure Special

On a freezing cold Friday November morning, 7 Warwick Racing members said goodbye to the rest of their team mates to embark on the most exciting opportunity ever to fall at the team's feet. The time had finally come to leave the IMC for Birmingham International airport, for a 24 hour flight to Melbourne. Laden with race suits and tools, we checked in, passed through security and boarded our first flight to Dubai. Following a further two security stops at Dubai and Kuala Lumpur (note to self: do not wear safety shoes to save case space, just pack less...) we landed safely in Melbourne.

Visas and declarations at the ready, we passed through Border Control surprisingly quickly (they're a lot nicer than their reputation indicates!) and we were ready to meet the Monash Motorsport (MMS) team at Arrivals. After 7 months of almost weekly communication, it was finally time to put real faces to the names. We were met by a handful of the MMS team with signs and banners, picked up our hire cars and temporarily said goodbye to our new friends. Thankfully the Australians drive on the same side of the road as we do in the UK. Confusingly, the indicator and wiper controls were on the wrong sides of the steering wheel. This led to days of frustration for the hire car drivers. After a few hours of chilling out, we unpacked our crate, checked into our accommodation and began to settle into our new surroundings.

MMS Sponsors

As part of our Alliance with MMS, we scheduled visits to some of their main sponsors. We had a test day with Bosch in the Australian Automotive Research Centre (AARC) and visited the homes of Dana and Marand for a tour of their facilities. We met a couple of British ex-formula student graduates during our site visits including Sam at Marand, an Oxford Brookes alumni and Damon at Bosch, a University of Birmingham alumni. Both the MMS and Warwick teams really enjoyed the site visits and thank Bosch, Dana and Marand for accommodating us.



Monash Motorsport-Warwick Racing Launch Event

Excluding competition, the main event happening during our stay was the highly anticipated launch of M13 and WR3. We had a busy day running around, making sure everything was ready, and smartening up to be publicly welcomed by our MMS friends, and show their sponsors, friends and other local teams who we were. The event was a huge success with over 200 people attending. We were fortunate enough to meet Andrew Coats, the Monash-Warwick Alliance Academic Vice-President, and he was able to see first-hand what a great success our Alliance has become.



Formula SAE-Australasia – Day 1 and 2

During the Australasian competition we stayed at a nearby caravan park in a cabin – luxury accommodation when compared to our usual base at Silverstone in a muddy field! We signed in, got our driver wristbands and were ready for the start of competition. The first day saw us set up our pit area and attempt to get an earlier scrutineering place, to no avail. MMS had had an early slot, and passed on Day 1 so we arrived early on Day 2 keen to follow their footsteps. We had the Design and Cost events first thing in the morning, but once they were out of the way the team went straight to scrutineering and managed to get a spot before our allocated time of 1pm. Following a few minor adjustments, we were through and onto Tilt, Noise and Brake testing. We passed Tilt and Noise first time, but due to some issues starting the engine reliably, we were unable to get through Brake before it closed for the day. Day 2 also saw our Business presentation in the afternoon, an event we have done very well in at UK for the past two years. We left on the second day hoping we could fix the starting issues early on Day 3 to allow us to compete in the upcoming dynamics events: Acceleration, Skidpan, Autocross and the ever dreaded Endurance.

Returning from Australia

We came 17th overall at Formula SAE-Australasia, and we congratulate our friends at MMS for winning first place for the fifth year running! The team really grew together throughout the trip, and we have learnt a lot as a rookie team at our first competition that will put us in good stead for Silverstone in July. We packed up the crate, said our goodbyes to our many new friends, and drove to Tullamarine airport for the long flight home.

We would like to say a massive Thank You to everyone who helped us throughout the trip, before during and after. Special mentions go to our wonderful hosts MMS, Hugh Venables, Monash-Warwick Alliance, Warwick SU, Bosch, the Materials and Innovative Manufacturing GRPs and the finance department at WMG, especially **Fran, Michaela and Paul**.

Formula SAE-Australasia – Day 3 and 4

First to arrive for the third day running, we were keen to complete Brake as early as possible. The kind Bosch representatives at competition lent us a CAM sensor (the source of our starting problems), and on our third attempt we passed Brake test! No time to celebrate as there was only an hour til Skidpan and Acceleration closed for lunch. We completed a run for both, allowing us to prepare for the Autocross event in the afternoon. We continued to start reliably and we completed 6 runs for Autocross. After the 6th run, the rear was making an unconventional noise, so we called it a day to diagnose the problem and prepare for Day 4. Fortunately, it was only a loose bearing and after giving the diff some more oil we were ready for Endurance. Unlike the UK competition, Australasia has two heats for endurance, so we had two shots to complete an event that WR3 couldn't at FSUK 2013. Amazingly, we managed to complete both! We were one of only 3 teams out of the 23 to do so. We competed at an international competition and completed all events. This remarkable achievement has given us high hopes for attaining a high scoring finish at our next competition – FSUK 2014.



Friends of Warwick Racing



This year Warwick Racing faces its biggest challenge yet with a multitude of new and exciting challenges to overcome. On Thursday 12th December 2013 our Australia contingent participated in the Formula SAE-Australasia competition and represented the only British entry there. Furthermore, next year Warwick Racing will be implementing an electric powertrain for the very first time, designed over a two year cycle. However, to ensure that successive teams are reading off the same page and to facilitate greater knowledge transfer between these teams, we hope to enter Formula Student Hungary in July and take as many first – third year students as possible. This will give prospective members invaluable competition experience and enable them to learn as much as possible from the WR4 team before we depart, as well as giving our existing team the opportunity to see how we fare against the fierce international competition. Warwick Racing has also initiated an outreach programme in local schools this year, with the aim of promoting STEM subjects and encouraging pupils to pursue a career within engineering.

However, entering two additional competitions in the space of one year poses a huge financial burden on our team. We are thus desperately in need of additional funding to ensure that the WR4 race car is successful and to facilitate the progress of our electric entry next year by competing in Hungary this summer.

Warwick Racing is thus extremely grateful for any financial contributions our friends, family and fans can offer us, to aid us in making this year the most successful year to date. We welcome financial donations of any size, no matter how seemingly small, in our efforts to raise approximately £26,000 worth of financial and in-kind contributions. Many of our donors receive our monthly newsletter detailing the team's progress and attend many of our events, including our prestigious launch event in the summer, where they have the opportunity to meet our team and see our race car.

If you would like to donate to our team please follow the link to our donation page below and enter 'Warwick Racing' in the gift direction section: <http://www2.warwick.ac.uk/giving/donate/online/single>

Alternatively please make cheques payable to 'University of Warwick' and post them to Omar Sabri using the Warwick Racing address on the following page. Should you have any further queries please do not hesitate to get in touch using the details overleaf. Finally, we would like to take this opportunity to thank the friends, family and fans who have donated to us so far, your contributions are invaluable and greatly appreciated.



Coming Up in February...

- Design Justification Day.
- Warwick Racing Return from Australia Debrief.
- Manufacturing Progress.

Outreach Programme

Our Outreach Programme aims to promote STEM (Science, Technology, Engineering and Maths) subjects to local secondary school pupils, encouraging them to consider these subjects for Higher Education. During Outreach days members of Warwick Racing undertake practical activities with small groups of pupils, highlighting the relevance of what they have learnt in Science and Maths lessons to the challenge they immediately face. In addition, we give the pupils an overview of our project and of University life, and dispel many of the misconceptions they may have.

Our first Outreach day at Campion School was a great success and so we are now hosting four more dates in March. We are also now integrating undergraduate students from lower years, providing them with the necessary experience to continue the programme for many years to come. Earlier this month we also spoke to 95 pupils and 14 teachers from 8 local schools, attending Warwick as part of a careers afternoon. The day was rounded off by a fascinating presentation on Bloodhound SSC, the upcoming supersonic car designed to travel at 1,000 mph.

Sponsorship

First of all we'd like to take this opportunity to thank all of our partners for their sponsorship and continued support throughout this year, without which much of our progress may not have been possible. As you know, Formula Student is a fourth year engineering project at the University of Warwick and is funded almost entirely by external sponsors. As such, we are extremely grateful for any support you can offer us and in return we can offer you a number of benefits including promotion of your company brand on our WR4 car, throughout our assembly area and on our website, as well as promotional opportunities within our university and access to our highly sought-after graduate recruitment market.

Warwick Racing welcomes support of any kind, whether it be direct financial or in-kind contributions, expertise, advice, materials, use of manufacturing facilities or assistance with testing.

If you would like to sponsor Warwick Racing or if you have any further queries, please do not hesitate to get in touch using the details below. Furthermore, our new Sponsorship Opportunities 2013/14 brochure contains a brief summary of our history, our core design philosophies for the WR4 car and a look at our diverse range of sponsorship packages.

Link to brochures:

http://www2.warwick.ac.uk/fac/sci/eng/meng/warwickracing/fs/sponsorship/formula_student_wr4_brochure_2013-14.pdf

http://www2.warwick.ac.uk/fac/sci/eng/meng/warwickracing/fs/sponsorship/formula_student_wr5_brochure_2013-14.pdf

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