

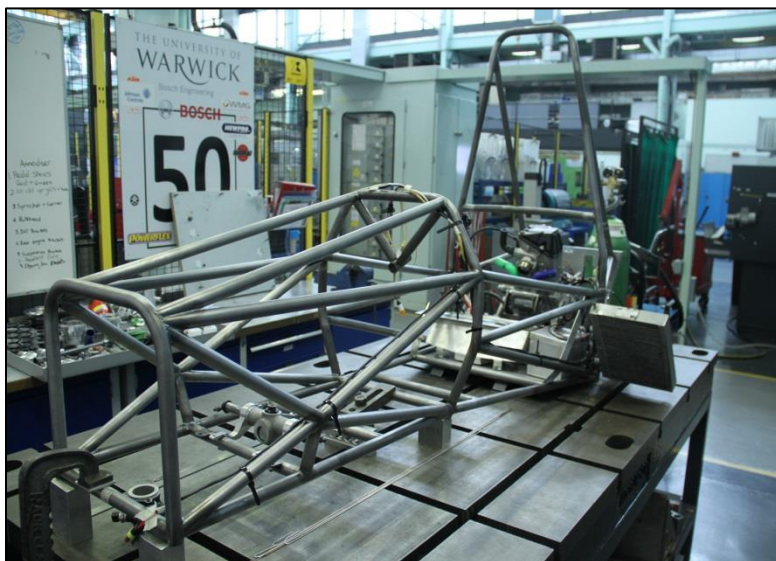
## Full Steam Ahead: Manufacturing Progress Towards a Rolling Chassis

February has seen the team come leaps and bounds towards their manufacturing deadline of a complete rolling chassis for the start of the Easter break. With the first of our major events this month, 'Warwick Racing Return from Australia' and the success of our Design Justification Day, February has provided much food for thought and given the team the opportunity to interact with a few of our many partners and supporters.

This month both the chassis and powertrain teams have been working hard to meet their respective manufacturing deadlines and prevent the overall completion of the car falling behind. The car is beginning to take shape thick and fast with the team spurred on by the continuous arrival of new parts, tools and financial and in-kind support.

### Design Justification Day

This year we wanted to incorporate the wealth of knowledge and power of hindsight from Warwick Racing's Alumni, by holding a design justification day where each team member presented their respective designs. The day proved invaluable with some great feedback and advice given by all those who attended. This allowed the team to reflect on their work and prepare for competition where they will come under intense scrutiny from the judges during the design event. Following the success of the day there are plans underway to hold a second event later on in the year aiding competition preparation further. More recently a few members of the team paid a visit to Ricardo's Midlands Technical Centre in Leamington; an insightful day which provided reassurance and guidance to further refine our designs. With great progress on the car this term and the deadline of Easter for the car to be complete, the team will be hard at it ensuring a professionally built and successful WR4.



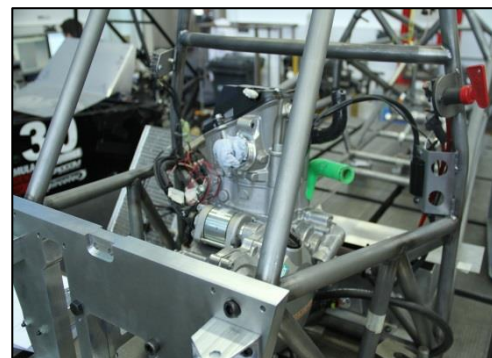
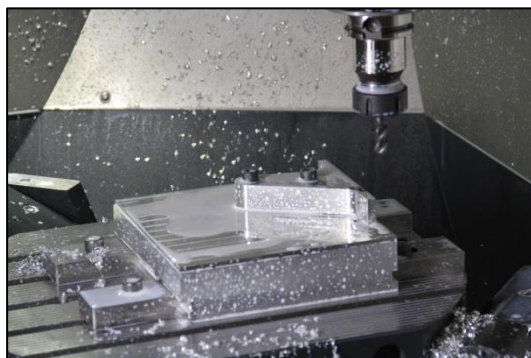
## Chassis

As manufacturing continues within the Chassis team, the array of seemingly miscellaneous parts are beginning to take the form of a car as the days slip by. With most of the major components nearing completion, we hope to have a rolling chassis by the Easter break to allow as much track testing as possible before competition in July.

Our nosecone is set to be manufactured in the coming weeks, our floors and firewalls are being mocked up and the final analysis is being done on our radiator pod. The last few bits of welding are also underway on the chassis, leading to a slight redesign of the seat, currently undergoing further experimentation.

Our suspension systems are finalised and are under manufacture, with special thanks to Ricardo who kindly reviewed our designs and pointed out a few areas of improvement to facilitate better handling. With suspension presenting such a fundamental aspect of our car, we are delighted to have industry experts at hand.

Work has also begun on our bodywork design and the general aesthetics of WR4. We are going for a new look this year, sleeker and more refined than last year - so keep your eyes peeled! In particular we would like to extend appreciation to LaserProcess, SHD Composites and Johnson Controls, all of whom are playing a key part in our aesthetic redesign.



## Powertrain

As the end of the second term approaches, the team are really working hard to manufacture and assemble all powertrain systems to WR4. We aim to have a fully-functional race car before the Easter break is over in April!

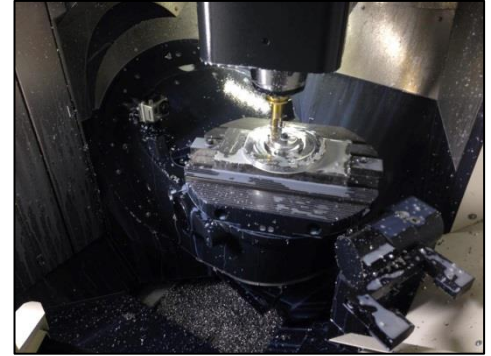
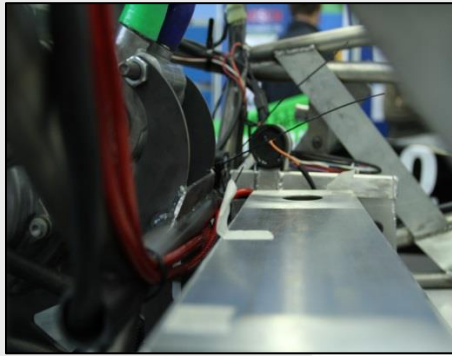
Since the last update there has been a lot of progress. The engine and radiator have been mounted onto the chassis, and the battery, ECU and wiring have been packaged into the vehicle.

The drivetrain is nearly complete, with the team already in possession of precision crafted output flanges from RL Walsh and tripod bearings from GKN. An order has also been placed with Brand Mechanical Engineering Ltd. for two lightweight, steel half-shafts and we're excited for them to arrive shortly. Furthermore, designs have been validated for both the induction and exhaust systems, utilising wave tuning software by Ricardo to optimise engine performance and mitigate against the Formula Student 20mm restrictor. In terms of manufacture, the exhaust is being welded and coated, and the induction system is awaiting rapid prototyping.

Our cooling system has been finalised and is currently undergoing CFD analysis to ascertain its capabilities. Real-world

testing will follow shortly, in conjunction with dynamometer testing of the engine and fuel system.

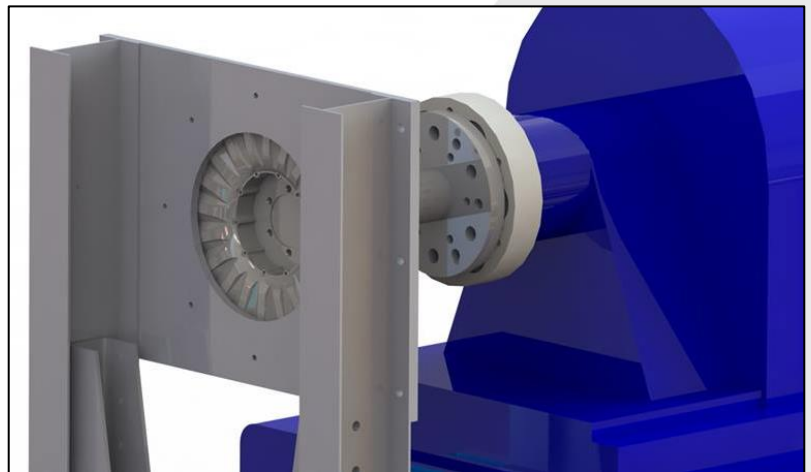
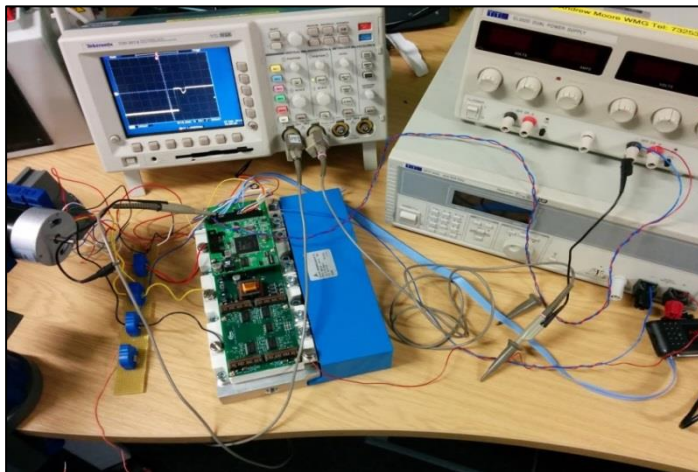
Finally, Warwick Racing's novel anti-shock sprocket system is presently being CNC machined by the expert WMG technicians. All that remains is validation of the high-performance polyurethane bushes that have been custom produced by Powerflex before the final drive is ready to go.



## Electric

February has seen the team camping out late in the electronics workshop for custom circuit board wizardry, coffee and troubleshooting. Most of the work this month has been focused around simulation and controls. The aim with regards to simulation is to have a backward-facing model that maps the energy and power flows throughout the vehicle, enabling us to perform 'sensitivity' and 'what-if' analysis for various drive cycles, helping us maximise vehicle performance predictability. The model is capable of iterative optimisation of various parameters (such as the final drive) to improve overall vehicle efficiency. Both deliverables are helping us to fulfil our mission statement of designing a reliable, robust and efficient vehicle without compromising performance.

The control aspect involves understanding the Pulse-Width Modulation behaviour of the motor controller, followed by using the GUI to communicate with the device through a computer over RS-232 channels. A small test rig (illustrated below) has been built to drive a small motor using simulated torque signals, with the ultimate aim being to scale up the controls framework to drive the Yasa 750 motor on the dynamometer in mid-March. Dates have been booked for the 12th and 13th March, with the countdown stirring all kinds of excitement within the team.



## Warwick Racing Return from Australia

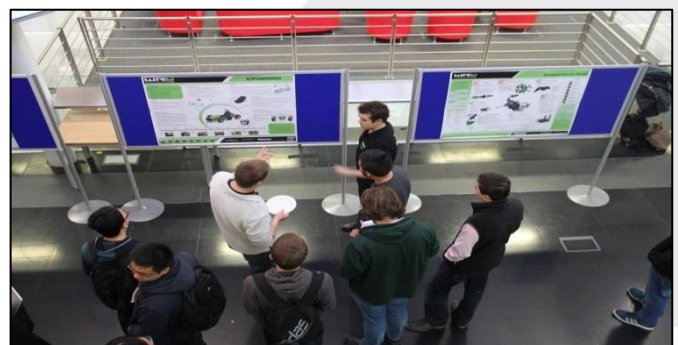
The afternoon of Wednesday 19<sup>th</sup> February saw the Warwick Racing team leave the familiar confines of the IMC workshop in favour of the IDL building. This was all in aid of an event arranged for our sponsors and supporters, to summarise our latest competition experience in Australia, and draw a line under the trip. This was the last time we would see WR3 fully assembled, with a planned strip down of the car the next day to get components ready to go on WR4.



The facilities team at WMG were really helpful in setting up the concourse how we needed it for the event, and Warwick Catering arrived with the mass of food and drink we ordered. After what seemed like hours to the team members (real time: 15 mins), the first of our guests arrived and the food was unwrapped and the boys were finally able to dig in. I can happily say the food was delicious, especially (and ironically) the shrimps! After a technical difficulty (or two...) everything was ready to go and our guests were ushered into the IDL Auditorium. The presentation part of the event incorporated a live video feed with our friends at Monash Motorsport, and it was great to be able to showcase our partnership so tangibly to everyone in attendance. We held a joint presentation with them, highlighting how our partnership started, and what it has since grown into. It felt nostalgic talking about our time in Australia, reliving truly exceptional, and sometimes very difficult, experiences. In a blur of photographs and a superbly edited video by 3<sup>rd</sup> Year Engineering student, Geoff Ruh, we summarised 8 months of hard work in just 30 minutes.

The main purpose of this event was to formally thank the sponsors of the team that contributed directly to our Australia campaign: Monash-Warwick Alliance; Innovative Manufacturing GRP; Materials GRP; Warwick SU; WMG Marketing and Recruitment. Without them, the trip would not have been possible, and the experience gained would not have happened. We concluded the presentation segment by saying Goodbye to Monash Motorsport: considering the 11 hour time difference, we really appreciated them staying up til 2am to be a part of the event. We're continuously working together in the run up to the UK competition. As soon as their end of semester exams finish they'll be flying to the UK to live, work and test with us in WMG before heading to Silverstone! Watch this space for further updates on our progress...

The afternoon was a great success for everyone involved and we're looking forward to our next big sponsor event after Easter. On that note, we would also like to say a massive thank you to **Ailsa** and **Sue** from the Monash-Warwick Alliance, **Rachel** from the Materials GRP, **Tracey**, **Mitesh** and **Lisa** from RS Components, **Phil** and **Pete** from Carrot Cycles, **Paul** from Jonathan Lee Recruitment, **Tom** from SHD Composites and **John** and **Kevin** from Aluminium Surface Engineering for taking time out of their busy schedules to spend the afternoon with us.



[racing.warwick.ac.uk](http://racing.warwick.ac.uk)



WarwickRacing



@WarwickRacing

## Friends of Warwick Racing



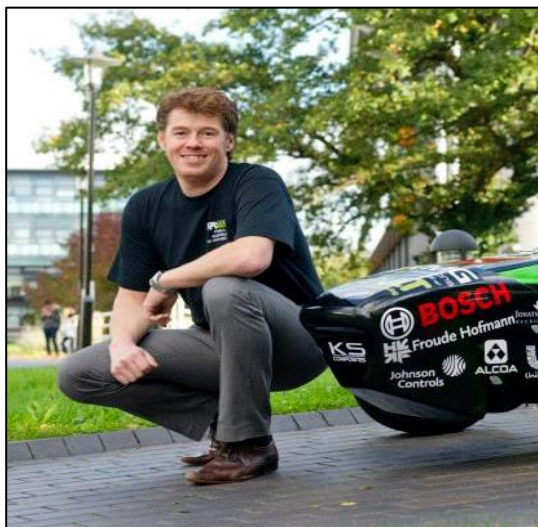
This year Warwick Racing faces its biggest challenge yet with a multitude of new and exciting challenges to overcome. In December 2013 our Australia contingent participated in the Formula SAE-Australasia competition and represented the only British entry there. Furthermore, next year Warwick Racing will 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 August 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 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 March...

- Rolling Chassis Complete
- Outreach Programme Update
- Easter Manufacturing Freeze

## Monash Motorsport-Warwick Racing Alliance

Welcome to our latest permanent feature in Warwick Racing's newsletters. Following the success of an initial exchange which saw Warwick Racing compete in Australia last year, we're excited to bring you an update each month of how our team's alliance with Monash Motorsport is progressing in the run up to our teams European campaigns.

With weekly video meetings and almost daily emails, we're working hard to plan the upcoming visit of our Australian friends in June. We're planning to host 30-40 of the Monash team, and so far have been successful in finding accommodation available on campus through Warwick Accommodation, and have kindly been granted additional space by WMG in the IMC workshop to accommodate the team during their stay.

We're currently investigating possible joint testing facilities to utilise during their stay. If you are interested and able to support our two teams with local test track facilities, please contact Hannah Sugrue on [H.M.Sugrue@warwick.ac.uk](mailto:H.M.Sugrue@warwick.ac.uk).

## 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_wr4_brochure_2013-14.pdf)

[http://www2.warwick.ac.uk/fac/sci/eng/meng/warwickracing/fs/sponsorship/formula\\_student\\_wr5\\_brochure\\_2013-14.pdf](http://www2.warwick.ac.uk/fac/sci/eng/meng/warwickracing/fs/sponsorship/formula_student_wr5_brochure_2013-14.pdf)

### Omar Sabri

#### Sponsorship & Finance Manager

Warwick Racing 2013/14

Tel: +44 7786 520880

Email: [O.Sabri@warwick.ac.uk](mailto:O.Sabri@warwick.ac.uk)

### Warwick Racing

IMC Building

WMG

University of Warwick

Coventry



**BOSCH**



Altair

**MILLBROOK**

**VARLEY RED TOP™**



**KS**



COMPOSITES



**CATAPULT**  
High Value Manufacturing



Johnson  
Controls



**AUTODESK**

**PRODUCTIV**  
Driving green technologies

JONATHAN LEE  
RECRUITMENT

**LaserProcess**



**limegecko**

THE UNIVERSITY OF  
WARWICK

tube~bender



**GRM**  
CONSULTING LTD

**Froude Hofmann**



**zircotec**  
heat management

**TITAN**

**NATIONAL INSTRUMENTS™**



**POWERFLEX**

**acorn**  
printing