



FEBRUARY 2018

EDITION 1

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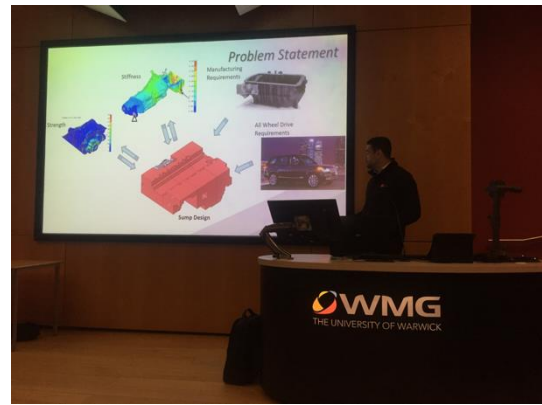
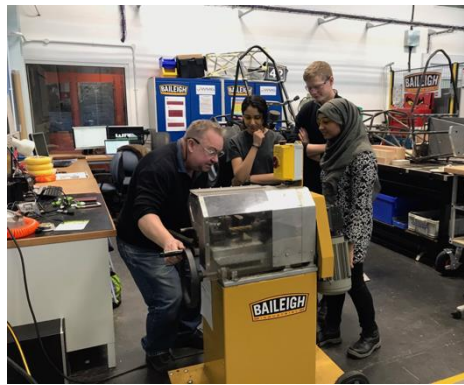
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AN INTRODUCTORY WORD

As Term 2 continues Warwick Racing's push for the summer competition at Silverstone heats up, with manufacturing of our first ever electric car in full swing! The Internal Combustion car has been busy too, with the front rocker suspension design complete and water jetted ready for assembly, as well as the design and validation of our next generation aluminium honeycomb monocoque chassis, with the team investigating the optimum honeycomb geometry, joining process and monocoque design. The electric chassis team have been busy completing the spaceframe chassis as well as beginning to manufacture the box section mounts for the suspension components of the car. They have also been getting members in the frame to find the perfect positioning for the pedal box and seat. The electric Powertrain team have been focused on the drivetrain over the last two weeks as well as simulating the performance of the motor. The Outreach team have been very busy with events this term, with Warwick Racing appearing at the GRP Charging Britain event at the International Digital Laboratory building at the University of Warwick and the science gala also at the university introducing a younger generation to the sciences and exciting new ideas. Find out more about what the team have been up too in this edition of our newsletter!

- Harvey Cumming, Business Manager



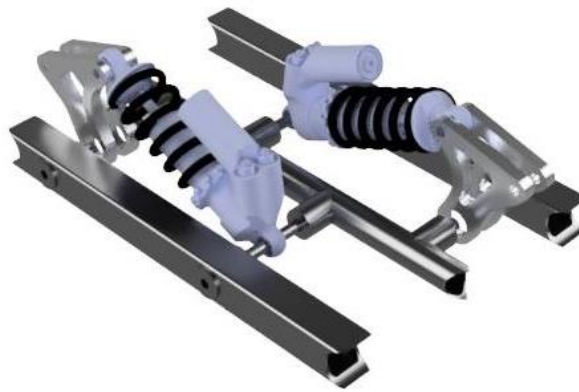
TECHNICAL UPDATE

DYNAMICS

The Dynamics team have had an exciting few weeks with designs for the suspension complete and manufacture underway. Additions to the chassis have been made using the notching machine from Baileigh for box section supports and the front rockers have been water jet, ready for assembly. They work as part of a pushrod suspension system that we will be implementing in the coming weeks and are now manufacturing the accompanying components, including bosses, spacers and pushrods. The CAD below illustrates the new assembly of the front rocker system for WR8, with four rockers; two positioned on each side of the shock absorbers.



Front Rocker Design



Front Rocker Assembly



Rear Rocker Design

The design of the rear rocker system is complete and now in the process of being manufactured. It works in a similar way to the front suspension, however there is only one rocker on either side of the car, as these have been designed to be much thicker and therefore able to withstand higher loads.

In the next few weeks our aim is to have the assembly of both the front and rear suspension completed and ready for testing.

TECHNICAL UPDATE

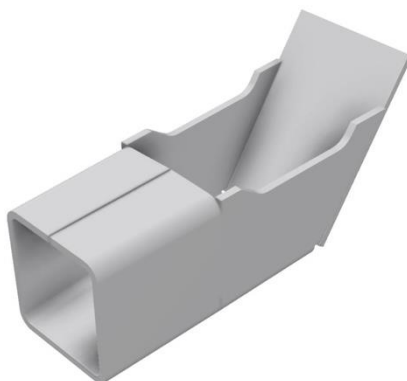
CHASSIS

Over the past couple of months, the chassis team has been working hard to design a new monocoque for next year's car. After much debate and thought, we have come to the conclusion that the main aims for this monocoque are to keep it modular to accommodate different types of powertrain by simply replacing the rear steel sub-frame, and to ensure a dynamically efficient and nimble chassis.

With the generosity and help from the suppliers of composite panels, especially Coretex, we have been successful in sourcing the aluminium honeycomb material for testing purposes. The two samples we have decided to test are a sandwich panel of aluminium honeycomb core with an aluminium skin, and another type of sandwich panel with the same core but a glass pre-preg epoxy skin.

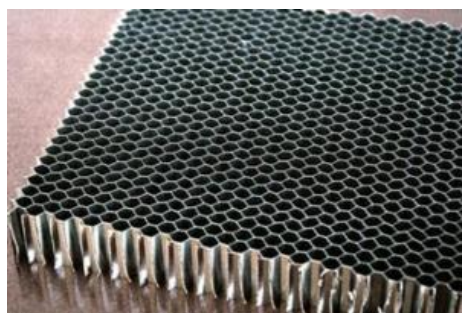
As helpful and knowledgeable as always, the technicians and mentors at WMG, especially Mr. David Cooper and Dr Ian Butterworth, have guided us to realise a feasible testing solution for the sandwich panels. The main tests we would need to carry out in order to validate the composite material for the chassis are the shear test, torsional stiffness test and the three-point bending test. A couple of members of the team are in the process of designing and building a custom rig for the tests.

The other members of the team have been working on different tasks, including looking into the joining processes involved in combining two composite panels. We also have an initial CAD model, but this will be updated with a newer iteration once changes have been made, as advised by the very knowledgeable Dave Cooper!



Initial CAD model of WR9

Our plan of action for the new iteration of the monocoque is to have a raised nose from the floor and at the same time provide a recess at the top to house the front rocker system and shocks of the suspension. By doing so, we ensure that we have a flat floor and mounting points for further aerodynamic features like a front wing or diffuser. Our goal for WR9 is to ensure that we will have a competitive car at competition, but most importantly, we are having fun and learning everyday as part of the process!



Aluminium Honeycomb Core



Sandwich Panels

ELECTRIC CAR TECHNICAL UPDATE

CHASSIS

The WRe Chassis team have been busy cutting and notching the final chassis members, and have the space frame now mostly complete. Work continues through this week and next to manufacture the box sections for the wishbone mounts, as well as reaming all wishbone sections to precisely fit the rose jointed inserts, and getting floor tabs mounted. Our bevel box steering system has also been finalised, with components specified and ready to order. The extra-curricular team have been a particular help recently, getting our body work mocked up and cut to size.



Testing the seating position

POWERTRAIN

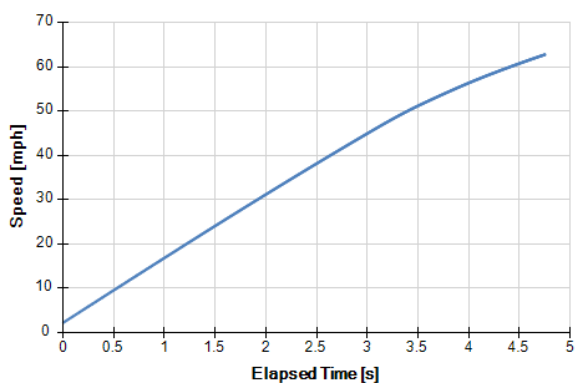
Recently the powertrain team have been making progress on the drivetrain. This is the connection between the motor and the wheels. The main features are a chain drive which allows the motor to rotate faster than the wheels for improved acceleration and efficiency, and a Drexler limited slip differential which improves traction and cornering ability.

At the Formula Student competition at Silverstone in the summer, the vehicle needs to be competitive in four different dynamic events. The acceleration event, autocross event, skidpad event, and endurance event all require different drivetrain characteristics. Packaging within the vehicle is also a major consideration for any vehicle subsystem. A compromise must therefore be made between acceleration, top speed, and energy efficiency, while conforming to packaging constraints. The drivetrain components must also be able to withstand the high torque generated by the high performance YASA electric motor.

Using OptimumLap simulation software, the gear ratio of the vehicle was optimised. Vehicle data such as mass, drag, and tire specifications were entered along with the torque curve for the YASA electric motor. The vehicle was simulated racing around tracks from previous Formula Student competitions to find the optimum gear ratio for the vehicle. The selected ratio for WRe is around 3:1 which should provide acceleration from 0-60mph in around 4.5s!

Some drivetrain components are already in stock and the remaining drivetrain components will be ordered next week. Assembly of the drivetrain should begin before the end of term. We look forward to getting WRe running so that the performance can be tested on a real track!

Simulated Acceleration of WRe



EVENTS

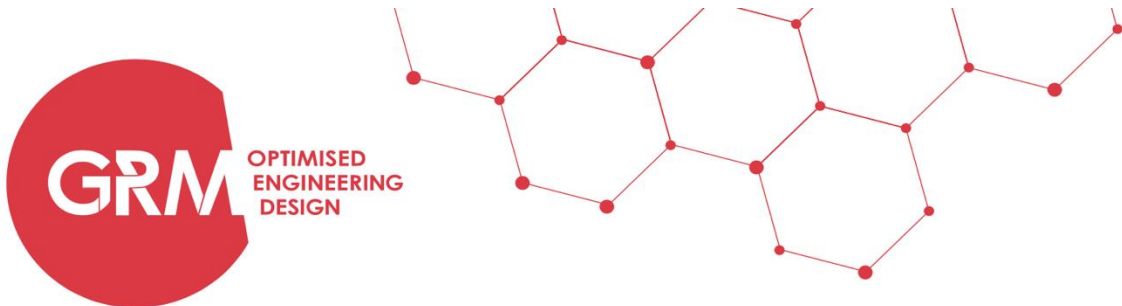
XMAS SCIENCE GALA

This week, Warwick Racing was proud to have ran its popular pit-stop activity at the XMaS Science Gala. The aim of the game? Change a wheel on WR8 within 3 minutes to earn yourself a laser-cut keychain! We had many participants from all ages, including a few adults. I suppose it was practice for those who hadn't changed a tyre before! Thanks to the support of the Innovative Manufacturing GRP, we were able to run a livery design competition. We asked participants to go wild with their imagination and come up with a paint job that would turn heads on the racetrack. Keep your eye out for the winners of this competition, who will feature in our upcoming newsletter.



UPCOMING EVENTS

Warwick Racing will be helping out on a series of upcoming Engineering offer holder days. The team will be also visiting Sarginsons Ltd.'s main site on 14th February. Sarginsons is the most technically sophisticated aluminium die-caster in the UK. They are one of a few European companies that offers low pressure die-casting, gravity die-casting, and sandcasting in the same foundry. We are very excited to receive a tour of the facility and learn more about the company's leading performance on low pressure aluminium die casting.



GRM CONSULTING'S ADVANCED DESIGN OPTIMISATION SUITE



Optimisation is a necessary part of engineering design. Whether you want to make your designs stronger, lighter, or cheaper, there's almost always going to be an iterative development process to improve the design. You could do this manually, of course, but why would you when it can be done automatically? GRM's software generates theoretically optimal designs using the finite element method, and is available either as standalone programs or embedded into your existing design and analysis systems.

GENESIS
An Enterprise Design Optimisation Software

Courtesy of Pilbeam Racing

GTAM/GSAM
Design Optimisation for ANSYS Mechanical

TRUFORM
Topology Optimisation for ABAQUS

TRUPLY
Composite Design Optimisation for ABAQUS



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