



# NOVEMBER 2 2017

## EDITION

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## AN INTRODUCTORY WORD

Warwick Racing has had a busy couple of weeks, with big steps in vehicle design on both the extra-curricular and Masters-project fronts of the team. We have been training this week with our sponsor GRM using their GENESIS software, a fully integrated FEA and design optimisation package. This has given our 4th year students the experience they need to undergo a full analysis of the strength and stiffness of their chassis and motor cradle for crash and dynamic simulation tests.

The highlight of our week, or perhaps I should say the highlight of our year, was our 2-day visit from the legendary ex-Chief Engineer of Lotus F1, Martin Ogilvie. We had a hugely inspiring couple of days with him, learning how to go through the process of designing a race car, and how to create a lightweight, affordable and successful Formula Student race car. The boost in motivation and enthusiasm Martin has brought, along with of course his vast knowledge, has really set our team of talented young engineers up for a highly promising year. We cannot thank Martin enough for his kindness in giving up his time to accelerate our development in race car engineering expertise. Read on for more information on his visit and the other exciting activities happening within the team.

- Matt Hill, Chief Engineer



## TECHNICAL UPDATE- MARTIN OGILVIE SPECIAL

### POWERTRAIN

The Warwick Racing Powertrain team acquired a wealth of knowledge and pointers for good powertrain design. Team members from the Cooling, Wiring Harness, and Air Intake projects attended drop-in sessions. For cooling, we learnt about how to effectively shape side-pods to maximise cooling effect as well as utilising the heated air exiting the side-pod. We also discussed material choices and the best manufacturing methods for different designs. As the side-pod is a large structure subjected to large amounts of airflow, it was important to delve into what the impact of having a single side-pod would be on the aerodynamics of the vehicle. The wiring harness team were given advice on how to approach rewiring the car. This involved looking at the best connectors to use in each place on the car. In order to help visualise the path of the wires, Martin instructed the Wiring Harness Team to construct a 1:1 replica of the WR8 chassis, a task the team have started on immediately. Once complete, a string model of the wiring harness will be created to find the most elegant solution to building the harness with as little wiring as possible.

This year, WR are looking to run our first ever overhead scooped Air Intake. Martin helped out Air Intake team appreciate the fluid dynamics at play before, inside, and after the air and fuel has entered the engine. The implications of using a single cylinder engine was also discussed as there will be points in time where there is no airflow into the engine. All in all this was a very useful experience, and we would like to thank Martin for the time he gave us and his unbounded enthusiasm in teaching us. Apart from teaching us the technical aspects of building a race-car, Martin helped the team develop a new thought process which is arguably far more important in creating a successful race car. We have all become far more competent engineers during the two days he spent with us, and we thank him sincerely for it.

### CHASSIS

Over the two days with ex-Lotus F1 Chief Engineer Martin Ogilvie, the Chassis sub team had extensive training and guidance on how to create a design for a monocoque. We were reminded of what the main functions of the chassis are - to connect the front and the rear of the car, and to provide torsional stiffness. Since the new vehicle is to be made out of aluminium honeycomb sandwich, a material in which Martin is an expert in, we learnt that honeycomb works best under compression.

Martin took the time to teach us the bending and folding techniques for composites and honeycomb structures, and how to join two sandwich panels together. Another important procedure learnt was the method of attaching components like suspension mountings to the monocoque. With all these processes taught to us, it provides an important boost in our goal of designing a monocoque for WR9 from a blank slate.



### DYNAMICS

The dynamics team learnt about the design of suspension systems through the art of keeping it simple but effective. Martin provided us with direction on our new suspension designs for WR9 and opened our eyes to ideas we wouldn't have previously known about. We drew up and discussed the pros and cons of 3 distinct push-rod systems, simple and lightweight solutions with a mono-shock suspension and anti-roll systems using torsion springs. Martin also had so many tips on weight reduction, strengthening mechanisms and manufacturability to help us strive towards success.

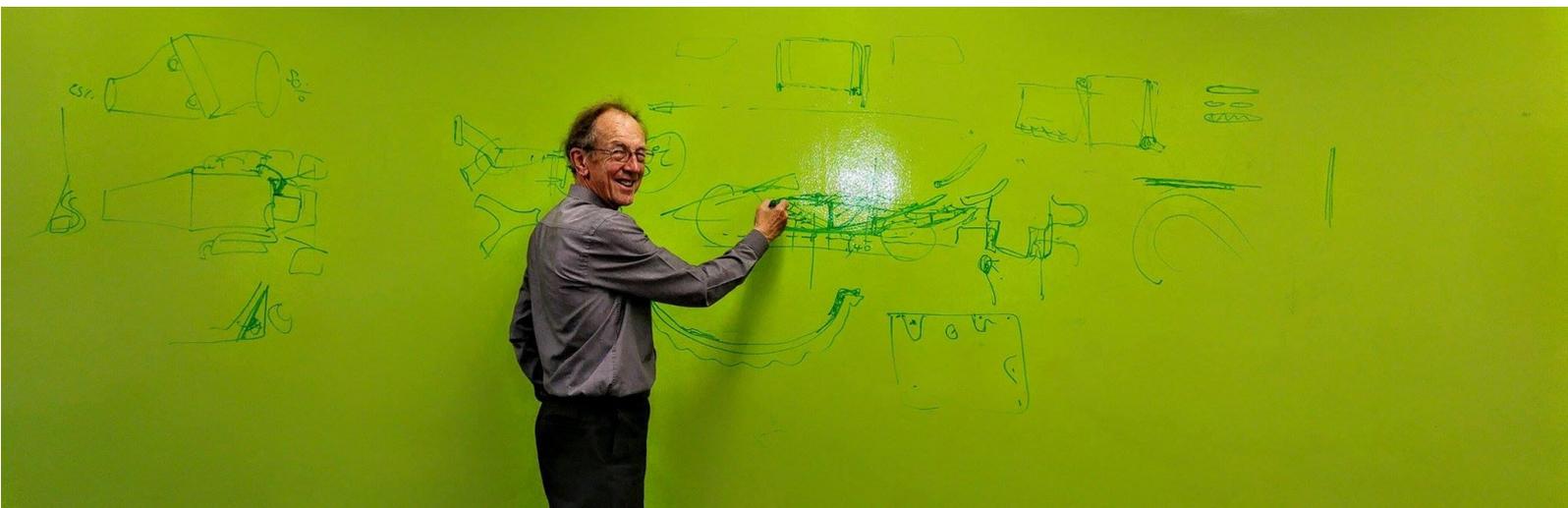
## TECHNICAL UPDATE- MARTIN OGILVIE SPECIAL

### MANUFACTURE

The meetings with Mr. Martin Ogilvie were of great use to the manufacturing department of the team. We went over the two main aspects of the team- the techniques that we will use to manufacture our future aluminium monocoque, and analysing components that will go on our current internal combustion chassis. Mr. Ogilvie gave us excellent pointers, such as what joining mechanisms to use (adhesives, local strengthening, rivets...) and how we can put the chassis together to optimise its stiffness and weight. We also went over some component designs that will go on our current internal combustion chassis, for these he gave us advice on light weighting and improving the ergonomics for the driver. He also used his extensive experience in Formula 1 to improve our pit jack design by including a battery mount which will be used to start the car in the pits and decrease the load on the car's electric system. Overall it was an excellent couple of days in which we got the opportunity to learn about all the different aspects of motorsports.

### TESTING

For Testing, Martin went through the general tests to be done before to a track such as bump steer, torsional testing and weight checking, including the methods, suggestions and how to change settings. This helped a lot with preparation of test days, as they can now be planned for in more detail. He also went through things to do on the day, including general lap, endurance and sprint tests as well as more details such as the number of laps to do between consecutive adjustments. He then gave several very useful tips and tricks, such as doing a fuel run down until the tank is empty to see how much fuel remains in the tank. This would be useful for calculating efficiency, range as well as actual fuel consumption. He also gave advice on the draft testing schedule and provided a testing checklist, which has a lot of common adjustments on it to resolve specific problems. This will definitely be thoroughly used. And then to top it all off, he even provided a list of set-up settings for cars which competed for Lotus! Martin took the time to teach us the bending and folding techniques for composites and honeycomb structures, and how to join two sandwich panels together. Another important procedure learnt was the method of attaching components like suspension mountings to the monocoque. With all these processes taught to us, it provides an important boost in our goal of designing a monocoque for WR9 from a blank slate.



## ELECTRIC CAR TECHNICAL UPDATE

### POWERTRAIN

Over the past two weeks we have been finalising the designs for various parts of the powertrain such as the batteries and cooling system and starting to source the various components we need. The battery design has been finalised so manufacture can begin soon.

A couple of team members visited the add2 offices in Birmingham to receive training in using the add2 software to programme the VSC.

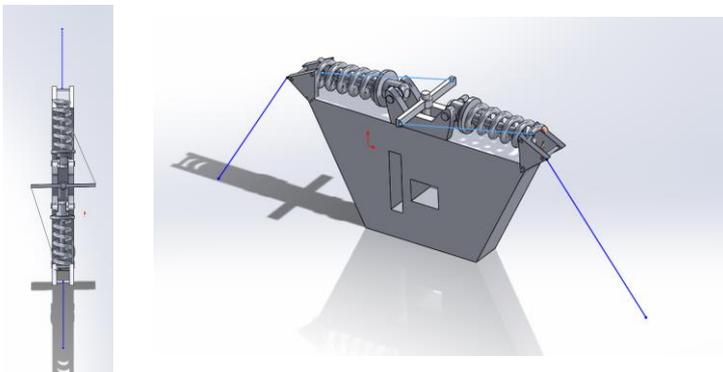
Some team members also attended a training session with GRM Consulting on use of the Genesis optimisation software in order to reduce the weight of some of the structural components.



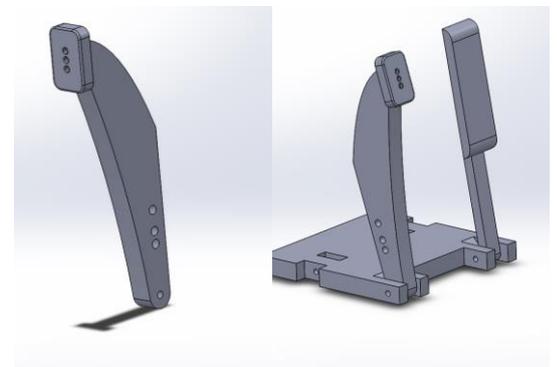
### CHASSIS

Below is an overview of the CAD concepts and ideas for the Chassis before GENESIS optimisation

Anti-Roll System



Uprights



### CROWDFUNDING THANK YOU'S

We'd also like to say a special, heartfelt thank you to the following people for having already donated generously to our campaign:

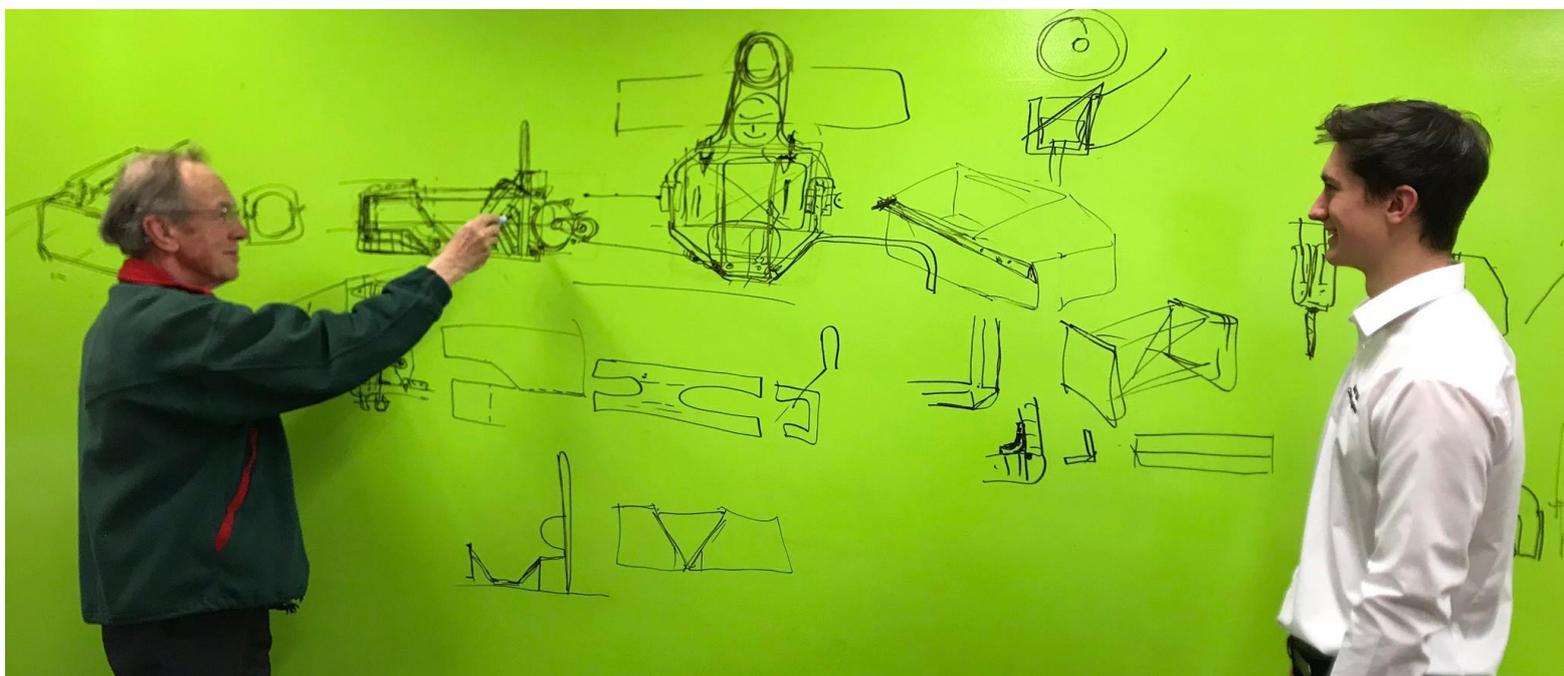
- Clara Valdes Arguelles
- Robert Brodie
- Matt Hill
- Shahida Khanam
- Jan Cumming
- James Steward
- Shafiu Alam
- Andrea Crowley
- Kat Carter

**EVENTS****DCA SPEAKER SERIES**

On 8th November, Warwick Racing held their first Warwick Racing's Speaker Series, presented by guest speaker DCA Design International Ltd, one of the world's leading product design and development consultancies, and our proud sponsor. The people that were present were able to learn more about the way this company functions and the projects they have been working on which delve into a broad variety of market sectors. The tasks they have applied themselves to range from the Stanley knife to the Eurotunnel Shuttle. It was an insightful and enlightening talk, and an event thoroughly enjoyed by our members.

**LOTUS F1: MARTIN OGILVIE**

Martin Ogilvie, ex-Lotus F1 Chief Engineer, graced the Warwick Racing team with his presence over the course of two days. On Monday and Tuesday, Martin Ogilvie ran sessions in which he provided the team with direction, and transferred some of his expertise to us. At the end of these two days, a final lecture was held to showcase a summary of what was achieved during our time with him. The various teams provided a small glimpse of the vast knowledge accumulated under Martin's tuition, boosting the whole Warwick Racing team's enthusiasm to apply these newfound concepts and discovering a range of new possibilities available. Martin Ogilvie was the presentation's last speaker, describing the team as "young enthusiastic people with great minds". Amongst the Colin Chapman quotes, Martin reiterated numerous times to "try and make things simple", and to think laterally, suggesting that we gain inspiration from unusual sources, rather than focus solely on how the formula industry operates. Martin has been an invaluable asset to the team, and not only has his visit inspired and reinvigorated everyone to strive towards success at the competition this year, his experience and insight will place the team at a great advantage.



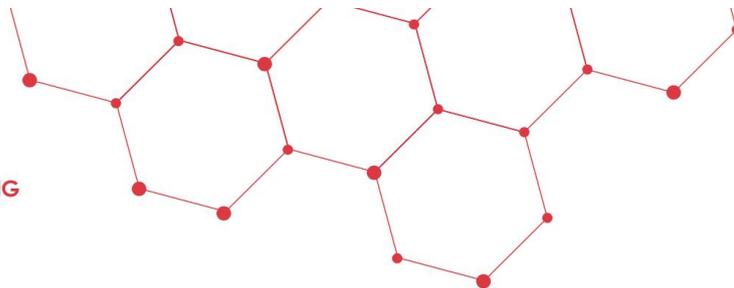
## UPCOMING EVENTS

### GRM CONSULTING

On November 29th, following DCA Design's successful speaker event, GRM Consulting will be the second guest to take part in Warwick Racing's Speaker Series. The company has multiple areas of expertise, which include product design, optimisation, and advanced simulation. GRM work in a variety of different industries such as aeronautical, defence, medical and motorsport.

### SARGINSONS

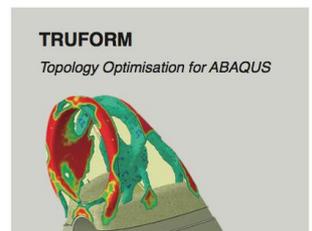
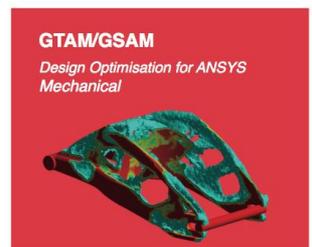
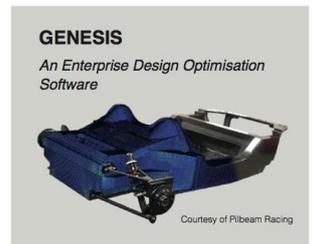
A visit to Sarginsons Ltd.'s main site is planned for the beginning of Term 2. This company describes itself as the "most technically sophisticated aluminium die-caster in the UK". They are one of a few European companies that offers low pressure die-casting, gravity die-casting, and sandcasting in the same foundry. Stay tuned for more details on this in the near future!



## 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.



TruForm SW



GTAM/GSAM



Genesis



TruForm Abaqus

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Bosch Motorsport



**BOSCH**



**HYLOMAR**



MSC Software

**DCA**

**POWERFLEX**



**U-POL**



add <sup>2</sup> Enabling Innovation



**StrainSense**



**SCHROTH**  
RACING

**CATAPULT**  
High Value Manufacturing

