



FORMULA
MANIPAL
Engineered with Passion

APRIL 2023 ISSUE

FORMULA MONTHLY



- Keeping up with Formula Manipal
- Deep Dive into the Aerodynamics & Composites Subsystem
- The Business behind Formula Student



“ To do something well is so worthwhile that to die trying to do it better cannot be foolhardy. It would be a waste of life to do nothing with one's ability, for I feel that life is measured in achievement, not in years alone.”

– Bruce McLaren

Keeping this in spirit, the team is preparing for the upcoming international competitions FS Austria and FS East (Hungary). The designing, fabricating and testing of various components is in progress for our new EV race car. Every team member has been working tirelessly testing the car and making necessary changes to optimize its performance.



MECHANICAL

- The E-Powertrain subsystem members have completed and validated the pressure drop calculation sheets. They have also completed the battery pack CHT simulations and finalised the cooling system and a single-circuit radiator for the EV. The team members have started the cylindrical battery pack's prototyping.
- The flap's prototype was created by the Aerodynamics & Composites team for testing. The next week will see the commencement of the wings' production. An abrasive water jet machine was used to cut the ribs that support the wings.
- The structures subsystem has been working day and night to design the new upcoming EV chassis. The team is experimenting with the 2-part-expanding foam to create custom seat inserts so that each driver may optimise his performance in the car. The design of the fixings for the EV chassis and adjustments to the CV chassis are also being done.
- The engine subsystem members have disassembled the engine from the car which will be serviced this week. The new intake manifold has arrived and will be mounted on the engine when the car is assembled again.
- The Vehicle Dynamics subsystem has completed and finalised the EV suspension design.
- The Transmission subsystem is working to have the differential produced. After being produced, it will be submitted for physical validation of the design, undergoing several tests including bending failure load testing, fatigue tests, and contact stress analysis.

DRIVERLESS

- The Nvidia Jetson AGX Orin arrived and was set up by the Driverless subsystem members. The CAN communication for the Throttle by Wire, UART communication for Brake by Wire, and PWM communication for Steer by Wire was established.

ELECTRONICS

- The Electronics team is primarily focusing on the assembly and testing of PCBs for the Data Acquisition System and Safety Circuits. Along with that the team is working on Frame Correction for the VectorNav IMU and making the wiring connections for the same.
- The Controls team is working on designing the new BMS setup for the upcoming Electric Vehicle. The team is currently in the stage of selecting a Master for the BMS and collecting Cell Temperature data from the Orion Thermistor Expansion module via CAN and Cell voltage data from DC2350A demo boards via SPI. Various iterations of software codes are being tried and tested to develop an efficient method to monitor cell Temperatures and Voltages. The testing and modification of EV safety circuits mainly the TSAL and the IMD is in progress.

FB Roadshow

- Our team also took part in the FB Roadshow event this month where the Formula Bharat team talked about the importance of rules and technical inspections, the importance of management and content creation, and gave us tips and pointers on how to ace our static events. The event helped us understand the importance of key aspects of the competition that will help us make better timelines and strategies to make sure we ace the competition.

Testing

- We did 3 testing runs in the month of April . The first run was 25 laps and two major testing runs completing 81 laps in the first run and 83 laps in the second one completing the laps required for an endurance event.
- In the first testing phase, we had some issues with gear shifting and the engine was getting hot very early. But that was fixed and by the second run the car was shifting at optimum rpm and the ECT values were also in good range due to which we were able to complete so many laps.

THE BUSINESS BEHIND FORMULA STUDENT

Formula Student is an international engineering design competition first held by the Society of Automotive Engineers in 1979, where the brightest engineering minds from universities all over the world come together to build and race their own high-performance race cars. It is the ultimate test of engineering prowess, innovation, teamwork and problem solving abilities.

Formula Student is not only a platform for engineering students to showcase their skills and innovation, but it is also a business opportunity for companies looking to sponsor and invest in the next generation of engineers and racers. The competition offers a unique platform for companies to market their brand image, products and services to an audience of college engineering students.


Sponsorship is a key component of Formula Student's business model. Formula Student teams require monetary and technical assistance to build their race car, organize their trip to the competition etc. Companies ranging from automotive manufacturers to technology companies provide financial and technical support to participating teams, in exchange for exposure to a global audience of engineering students. For sponsors, Formula Student is a valuable opportunity to showcase

their brand, products, and services to an engaged and knowledgeable audience.

In addition to sponsorships, Formula Student also offers various marketing opportunities to companies. These include branding and advertising on the race cars, at events, promotional campaigns on social media, and exposure through the competition's website and other digital platforms. Companies also use this platform to engage with students and recruit future talent for their organizations.

They also tap into the growing interest in sustainable mobility and eco-friendly technologies. Many teams are now focused on developing electric or hybrid cars, which align with the sustainability goals of the automotive and motorsports companies in general nowadays.

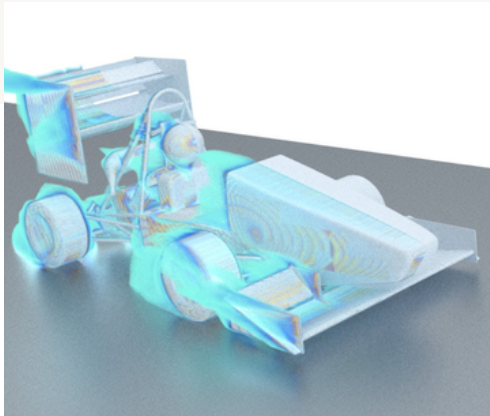
In conclusion, Formula Student is not only a competition, it is a business opportunity for companies looking to invest in the future of engineering and motorsport. Through sponsorship and marketing opportunities, companies can leverage the competition to increase their brand visibility and engage with a highly skilled and motivated audience. Formula Student is a win-win for both the competitors and the companies that support them.



**FORMULA
STUDENT**

MAY THE DOWNFORCE BE WITH YOU

FORMULA MANIPAL'S AERODYNAMICS AND COMPOSITES SUBSYSTEM



In the case of the automotive or the motorsport industries, aerodynamics is the study of moving air over a car in motion, and how that airflow will affect the car's movement through the flow.

The aero package consists of the front wing, rear wing and underbody of the car. The main purpose of the aero package is to create downforce rather than lift. This keeps the car on the ground at high speeds and increases the grip around the corners because the air under the car is moving faster than that the air above it. Slower moving air creates greater pressure, forcing the car down against the track. This downforce must be balanced against drag, which slows down the car.

Composites are made from combining two or more different materials together to create a composite with optimised properties. Usually these two materials are a polymer matrix and a reinforcing agent such as a fibre. We mainly use carbon fibre.

THE MANUFACTURING JOURNEY OF THE AERO PACKAGE :-

- Design: Choosing an appropriate airfoil, no of elements in the wing for the multi element wing, considering the mass of the whole package and putting together every part for the next step.
- CFD (Computational Fluid Dynamics) analysis: Testing the whole designed package to see whether it works or not, making iterations so that it works properly after fluid analysis.
- Stress testing of the whole wing on ANSYS so that it bears the load required.
- Deciding on the manufacturing techniques to be used.

- Ordering materials for manufacturing such as the molds, resin, carbon fibre, core materials etc.
- Main manufacturing is done in house by a hand lay up and vacuum bagging process.

This process includes sanding the mold, adding a releasing agent such as PVA on the mould. The first layer is of resin, then another layer of carbon fibre fabric is added on top, this is repeated as per requirement. The final layer should be of resin. Add the peel ply layer and the other female mould on top. The breather fabric is applied wherever required and a vacuum bag is placed using sealing tape. Air, if present is removed from the system using a vacuum pump and the whole system is held using additional weights on top to apply even pressure. The whole composite is then set aside to cure.

- First prototype manufacturing: checking if all parameters are correct.
- Wing manufacturing and testing.

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**RS 1000 OR US \$20 IS ALL IT TAKES TO BE A PART OF
THE FORMULA MANIPAL FAMILY!**

**FOR FURTHER
ENQUIRIES CONTACT :**

Team Manager - Aniruddh Ande
Contact No - +91 9869711924
Email ID - formulamanipal@manipal.edu
Website - www.formulamanipal.in

