



**FORMULA**  
**MANIPAL**

*Engineered with Passion*



## **MARCH 2023 ISSUE**

- Keeping up with Formula Manipal
- Deep Dive into the Structures Subsystem
- Welcoming Ashok Leyland as Formula Manipal's latest sponsor

**FORMULA MONTHLY**

## KEEPING UP WITH FM

“I’ve always believed that you should never, ever give up and you should always keep fighting even when there’s only a slightest chance.”

- Michael Schumacher

This month has been busy for the entire Formula Manipal team as they prepare for the upcoming international competitions FS Austria and FS East (Hungary). Every team member has been working tirelessly testing the car and making necessary changes to optimize its performance. Additionally, the designing and testing of various components have begun for our new EV race car.



### MECHANICAL

- The engine subsystem members have finalized the new intake manifold design and it will be sent for 3D printing. The team has also manufactured baffles for the new oil reservoir.
- During our recent testing period, our left stub axle broke along with buckling in the right half-shaft. Our transmission subsystem members are further optimizing the driveline for the CV. They are also in the process of designing and manufacturing more optimized half-shafts and stubs to further improve the reliability of the car. For the EV car, they are currently optimizing the layout of the transmission components on the chassis as a decision has been made to not have the rear bulkhead for a more compact arrangement, without compromising the reliability of the car. Furthermore, the team is also working on designing our first custom open differential for the EV.
- Our Structures subsystem designed a new steering wheel for our combustion vehicle. Apart from this, they also made seat inserts with PUF-75 2-part liquid foam.
- The Vehicle Dynamics subsystem members have been designing various components such as the pedal mounts, suspension, upright and its analysis, and the brake rotor and its analysis for the EV car.
- The E-Powertrain subsystem members recently completed the torque testing of the EMRAX 208 with a cooling setup, and the design of the HV battery pack. Furthermore, they have started on the design of the EV with the team.
- The Aerodynamics and Composites subsystem members have finalized the mounting of the front wing and the rear wing. In addition, the mould of the wings has arrived in the workshop and hence, the prototyping of the wings will start soon.

### ELECTRONICS

- The controls subsystem members have set up the EV powertrain from the FM20e for load testing. This test bench setup for load testing comprises the EMRAX 208HV, PM100DZ, LV & HV test bench harness, planetary gearbox, and the rear suspension setup. Only the rear brake setup has been bled to an extent to act as a larger load to test the motor's torque levels. This load-bench setup has been successful but issues were faced in the alignment of the resolver due to its mounting issue. The current OEM resolver spacers are the cause for this, so they are in the process of finding a solution for this from the EMRAX itself. The BMS master chosen as of now is the Teensy 4.1 microcontroller, where they are in the process of integrating the Orion thermistor expansion modules (for cell temperature monitoring) via CAN to the master.
- The electronics team is currently working on designing and debugging the safety circuits used in the car namely BSPD and System Critical Signals. A new PCB for BSPD is being designed and will be tested once it is fabricated. The Teensy 4.1 was selected to be the new Main Controller for the DAQ system. The team is working on interfacing VectorNav VN-200 with it to get data for Velocities, Accelerations, Yaw, Pitch, and Roll. This data is critical for the validation of the Vehicle Model. Along with that, the team has been working on improving the overall packaging and robustness of the wiring harness.

FORMULA MANIPAL'S

# STRUCTURES SUBSYSTEM



Our structures subsystem is in charge of designing, fabricating, and manufacturing the chassis. While designing the chassis, they aim to strike the perfect balance between weight and stiffness. They also keep in mind the ergonomics and safety of the driver. Different components of the chassis are constrained, keeping in mind the safety of the driver.

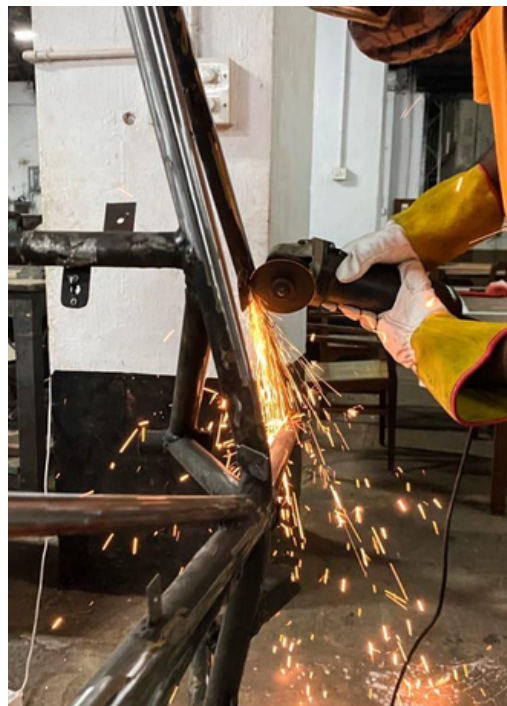
Strict FSAE rules are followed at all times to ensure a properly designed chassis that will protect the driver. In addition, they take care of the body panels of the car, made of carbon fiber to reduce the overall weight.

## THE MANUFACTURING JOURNEY OF A RACE CAR CHASSIS: -

1. Create an Ergo Jig to get the various body measurements of the driver.
2. Suspension point coordinates are taken from the Vehicle Dynamics subsystem.
3. Designing the chassis on Fusion 360 with respect to suspension points.
4. Analysing the chassis CAD on Hyperworks.
5. Designing and manufacturing of fixtures.
6. Make drafts of various tubes of the chassis.
7. Profiling and cutting of tubes and brackets.
8. Assembly of fixtures and tubes and lastly the welding of the chassis.

The chassis of a car is the structural framework that supports all the components. The chassis is responsible for the structural integrity of the car, which in turn allows it to handle loads while driving the car. The design of the chassis has a significant impact on the handling and performance of the vehicle. The chassis has several functions: -

- It bears the load of the vehicle body and driver.
- It provides the space and mounting location for various aggregates of the car.



# ASHOK LEYLAND

**OUR NEWEST SPONSOR**



**ASHOK LEYLAND**

## **ACHIEVEMENTS OVER THE YEARS**

- **The first Indian company to introduce fully air-conditioned buses and the hybrid bus.**
- **They are at the forefront of electric mobility in India and have introduced several electric vehicles, including the Circuit Electric bus and the E-Dost Light commercial vehicle.**
- **A major supplier of defence vehicles to the Indian Armed Forces.**
- **They have also won several prestigious awards, including the Deming Prize for Total Quality Management, the National Energy Conservation Award, and the Golden Peacock Award for Corporate Social Responsibility.**



Ashok Leyland is a name that resonates with reliability, durability, and innovation. With a legacy spanning over seven decades, this Indian multinational company has been progressing in the automotive industry with its exceptional vehicles and technology. From buses to trucks, Ashok Leyland has carved a niche for itself as a market leader. If you're looking for a partner that's dependable, forward-thinking, and committed to excellence, look no further than Ashok Leyland.

The company is a subsidiary of Hinduja Automotive Ltd and an integrated automobile company. It is headquartered in Chennai, Tamil Nadu. From a broad range of commercial vehicles to cater to every customer's needs to power solution systems, Ashok Leyland truly makes it's customers' lives easier.

Every team member in Formula Manipal works extremely hard to ensure the team's success at competitions. Ashok Leyland's sponsorship to Formula

Manipal provides crucial support that fuels the hard work and passion of the team. Their support enables us to focus on pushing the limits of technology and engineering to create the best Formula-style race car we can. Moreover, Ashok Leyland's sponsorship is a strong validation of the team's efforts and achievements. It acknowledges the hard work and dedication of all the team members, motivating them to continue pursuing their passion for racing and striving for excellence.

We would like to express our heartfelt gratitude to Ashok Leyland for sponsoring our team. Thank you, to the team at Ashok Leyland, for believing in us and investing your precious time and resources in our future. We look forward to representing your brand with pride and achieving great success together for several more competition seasons to come.



# KEYNOTE FROM THE BOARD

## **ANIRUDDH ANDE TEAM MANAGER**

In the next few months leading up to the competitions, we will face numerous challenges and obstacles, but I have complete faith in our team's ability to overcome them. It is imperative that we continue to work together as a team, supporting and encouraging one another every step of the way. Let us remain focused on our ultimate goal, which is to design and build a winning race car.

I am confident that with our team's hard work, dedication, and passion for motorsports, we will achieve great success in the upcoming competitions. As we continue to fine-tune our design and test our vehicle, let us remember that every decision we make and every action we take will have a direct impact on our performance.



## **ARYA BOBADE EV TEAM LEADER**

We have come very close to the FS Austria and FS East competitions, and I am proud of the progress we have made so far. Our car is looking great, our drivers are well-trained, and our sponsors are supportive. However, we still have some challenges ahead of us, and we need to work hard to overcome them.

I am confident that we have what it takes to do well in this competition, but we cannot afford to be complacent. We need to stay focused, motivated, and positive. We keep in mind that we not only represent our University, but our country too.

## **SAMAR JAKHAR CV TEAM LEADER**

In preparation for the International Competitions the team's primary focus has been testing and driver training. Through this process the goal is to make the car as reliable as possible and to ensure each driver has gone through enough training to be confident behind the wheel for the dynamic events. Gathering data through testing is another important aspect as it will allow the team to validate designs and thus, help us in preparing for the engineering design event.

As we move forward, let us remain committed to excellence, both on and off the track. I look forward to seeing each and every member of the team rise to the challenge and make Formula Manipal proud. Let's show the world what we are capable of.



Thank you  
**TO OUR SPONSORS**



**MANIPAL**  
ACADEMY of HIGHER EDUCATION  
*(Institution of Eminence Deemed to be University)*

**SCHAEFFLER**



**SIEMENS**



**INSULA**





## CC Buyers for the previous month

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**Rachit Mathur**

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***BUY A CC***

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

**FOR FURTHER  
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