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UPDATE

MAGAZINE

EDITION

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COMPETITIONS

IN 2023, OUR TEAM WILL PARTICIPATE IN THREE INTERNATIONAL COMPETITIONS

FS FEUP has some exciting news to share! The team will be competing in three different Formula Student competitions this year. First, we will be returning to Formula Student UK in Silverstone to compete in both the Static and Dynamic Events of the Electric Vehicle Class, as well as in the FS-AI (Dynamic Driving Task) Class with a prototype provided by the organization.

Next, the team will be participating in the highly prestigious Formula Student Germany 2023 competition, which takes place from August 14th to 20th in Hockenheim. The whole team is thrilled to be part of this important event in the world of engineering and motorsport.

Finally, FS FEUP will also be present in the second edition of Formula Student Portugal, which will take place from July 31st to August 6th. This is a big step for Formula Student in Portugal and the team is excited to be a part of it.



In summary, FS FEUP will be competing in three different Formula Student competitions this year: Formula Student UK, Formula Student Germany, and Formula Student Portugal.

We are looking forward to showcasing our electric car and autonomous driving algorithm, and to competing with the best university student teams from around the world!

DEPARTMENT **UPDATES**

DRIVERLESS

In the past few months, our newest department has been focused on making some improvements on their work, specifically in the following points:

Integration of cone detection models in a simulation environment: This project involves incorporating cone detection models into a simulated environment. These models will allow our car's system to detect cones in the competitions and take appropriate actions in response to them. Integrating these models into a simulated environment is an efficient way to test and validate their accuracy before implementing them in a real-world environment.

Improvements to the control algorithm: The goal of this project was to enhance our existing control algorithm that is now capable of following a predefined trajectory with a certain level of accuracy. This will allow for more precise and consistent performance when the time comes.



Selection of the trajectory planning method to follow and beginning of implementation: This work involves selecting an appropriate method for trajectory planning for our system. After selecting the appropriate method, the team began experimenting in order to achieve high precision and efficiency.



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ELECTRONICS & SOFTWARE

Currently, the department's focus has been divided between connecting the various components that we already have with us, such as the Battery Management System (BMS), controller, and charger. In addition to this, we have been working closely with the powertrain department to conduct cell discharge tests in order to validate certain cell parameters.

Connecting the components is an essential step in building the complete system and ensuring that they work together seamlessly. This involves integrating the BMS, controller, and charger to create a functioning battery system.





On the other hand, conducting cell discharge tests is crucial in understanding the performance and capabilities of the battery cells. This involves discharging the cells to a certain level and measuring various parameters such as voltage, current, and temperature. By validating these parameters, we can ensure that the battery system operates safely and effectively.

Overall, the department is focusing on both the hardware and testing aspects of the battery system to ensure that it meets the necessary requirements for our project.

CHASSIS & AERODYNAMICS

Our chassis department has been one of the stars of the season, by completing the manufacturing process!

To manufacture the chassis, firstly the tubes were laser cut to the desired shape. Then, a thorough alignment procedure guaranteed all the components were positioned correctly for the subsequent welding. During this process, the team encountered several challenges which required some minor design changes in order to ensure a seamless manufacturing.

Additionally, all the mounts for the car's components were positioned and welded to the chassis.

This was a task that required communication between several departments to ensure all components were in the correct position and securely fixed to the chassis, which will be crucial for the car's performance and safety.





Despite the obstacles faced, the team successfully completed the production of the chassis and is currently moving onto the next stage of the manufacturing process, which involves integrating the other components of the car onto the chassis.



POWERTRAIN

Our powertrain department has been focused on the accumulator, mechanical integration, cooling and transmission.

Regarding the accumulator, testing has already begun with the arrival of the cells, including assembly of segments and cooling tests to thermally characterize the cells. Constant current tests at 1C, 2C, and 3C have been conducted at room temperature and in a closed environment to simulate an adiabatic regime. In terms of construction, printing parameters have been improved to enhance stack print quality, and laser cutting has been completed on the plates.





As for mechanical integration, all electro components have been integrated into the car, and all plates have been cut and are ready to be assembled.

Speaking of cooling, with all components present, the focus has been on planning their testing, with preparations being made on how to conduct the tests and process data.

In terms of transmission, the design of all components has been finalized, and the manufacturing of various parts is progressing, with the entire transmission expected to be assembled in early May.

SUSPENSION

Currently, the suspension's department primary focus is on machining the various components of the suspension system. The opportunity to work with our partner, Haas, provided the chance to create our own CAMS. This opportunity proved to be very valuable in helping to understand the complexity of the parts and the challenges they pose during production.

To address some of these challenges, the team is making some small adjustments to the production drawings of the parts. These changes should make it easier to machine the parts and ultimately streamline the production process. The team is also working tirelessly to finish the CAMS, which is a critical component of the suspension system.

The goal is to complete the machining of all components by midnext month. At the same time, the department is also working on the steel suspension arms, which are currently in the process of being machined. Some of the sheet metal for these arms has already been cut, which is a promising sign of progress.

The department is also developing a JIG for bonding the carbon fiber suspension. This JIG will help ensure that the bonding process is efficient and accurate. Once the JIG is complete, the focus will fall on organizing the logistics of the bonding process to make it as fast and effective as possible.

Overall, the team is working hard to ensure that the suspension system is of the highest quality and meets all necessary standards, constantly looking for ways to improve the production process and make it more efficient.



LOGISTICS

The Logistics Department has been working on several fronts. Currently, the main points of focus are the preparation and development of static events for competitions (Cost Event and Business Plan Presentation), planning of travel arrangements for competitions, and internal organization during the critical period between manufacturing, deliveries, and the start of assemblies.

Regarding the static events, Logistics and the team Treasurer have been responsible for the Cost Event, while Logistics and Sponsors have jointly been responsible for the **Business Plan Presentation.**

Both events are crucial for the team's final result in the competitions. The Cost Event is related to the total cost of the car, justifications of engineering decisions made in terms of cost efficiency and results, etc., while the Business Plan Presentation is more related to the development of a coherent, financially justifiable, and appealing business plan that involves our car as a product.

In terms of travel arrangements for competitions, planning has been hindered by the team's current budgetary constraints. A strong effort to search for new partner companies with this purpose has been made. In addition, the development of a concrete plan for the competitions is crucial for facing the challenge of taking a prototype to competitions around Europe for the first time.

Regarding internal organization, the team's need for adaptation is constant when some parts of the car are ready while others are still in production since demands may arise with unpredictability and urgency.

The organization of inventory of material, parts, and components is essential for the smooth running of the next phase that is approaching, which is the assembly of sub-systems and complete systems in the prototype.

SPONSORS

The Sponsors department at FS-FEUP serves as the primary point of contact for external relations. Its primary responsibility is to engage with potential sponsors and secure monetary or in-kind support, including manufacturing services and components. To accomplish this, the department works closely with other departments within the organization to ensure that the team's needs are met.

In recent months, the Sponsors department has been focused on securing technical components for car assembly and logistical support for competitions, working closely with specific contacts to ensure timely delivery. Additionally, the department is responsible for partner outreach planning, which is a critical aspect of the organization's overall marketing strategy.

To successfully execute these tasks, the Sponsors department is responsible for content approval and contact follow-up with partner companies. This is a continuous process that requires a great deal of attention to detail and timely communication with partners. As a result, the Sponsors department plays a crucial role in ensuring the success of FSFEUP's events and competitions.



MARKETING

The Marketing department has been focusing on improving the multimedia experience for its social media followers in recent months, transitioning from a more traditional static graphic design-focused marketing strategy to a video-focused strategy that takes advantage of short, vertical video formats on platforms that offer higher engagement and capitalizing on this recent trend.

As a result, we have seen an increase in both engagement on our posts and the number of new followers and viewers, allowing for greater exposure of our team as well as all of our project sponsors who support us.



This new strategy has focused on identifying three groups of content produced: content from our sponsors, manufacturing and technical content, and personal content.

Building on the success of the Weekly Update - a weekly video update of our team's work and dayto-day activities - the Marketing department has decided to create complementary series: the FS FEUP Dá Que Falar podcast, the Manufacturing Update where we explain the status of the prototype manufacturing every two weeks, with more technical content, and Quick Interviews where guests who have been supporting the project in various ways since its inception talk about their contributions to the growth of FS FEUP.

These digital series aim to give greater exposure to the project and make a change in strategy to become a consistent and appealing source of digital content for the academic, business, and Formula Student communities.

COMPANY **VISITS**

On March 10th, the FS FEUP team had the opportunity to visit Bosch at the "Get to know Bosch" event held at the Bosch Technology and Development Center in Braga. During the visit, team members had the chance to learn more about the company and its specific areas of focus, including sensor technology and applications for fields such as autonomous driving and IoT. The visit provided valuable insights into the latest industry trends and technologies, which could be helpful in the team's development.

In addition to the Bosch visit, the FS FEUP team also visited several other project partner companies during this period, including Pemel Metal, ROQ International, and Haas Portugal. These visits provided opportunities to network with industry professionals and gain insights into their manufacturing processes and technologies.

The team was able to gather useful information that could help boost our own project development and manufacturing processes.

TECHNICAL TRAINING COURSES

These past few months, our team has gone through a series of technical training courses focused mainly on our Eletronics and Software department.

The PCB soldering course was initially designed for new members of the electronics department to help them integrate with the use of Altium, the PCB design software that the team uses (sponsored by Altium). However, we saw interest from other departments in learning about the PCB design process. Therefore, the workshop was open to everyone on the team.





The workshop was divided into two parts. In the first part, the PCB itself was designed, and for the second part, after the PCBs and components were ordered, was time to solder the board.

At the end of the workshop, all members had a functional binary counter PCB and a keychain.

The high-voltage safety training for working on electric cars was given by our partner company, Car Academy. The goal of this training was not only to educate our team about the safety rules for working on our car, but also to provide the necessary training



for some members of the team to take on the role of ESO (Electric System Officer) in competitions.

These members have the responsibility of ensuring the electronic safety of the car not only during work on the vehicle but also while it is being driven and during the charging and display phase. The training covers topics such as working with high voltage systems, identifying potential hazards, and taking appropriate safety measures.

The aim is to ensure that our team members are well-prepared and equipped to handle any issues related to electronic safety during competitions.

DESIGN REVIEW

"The Design Review was a first attempt to foster a crucial point that, from my point of view makes a big difference in the future of a Formula Student team: the presence of an interested and participative community of alumni.

Many former students who were part of the team continue their careers in areas that are extremely compatible with what is developed in Formula Student.

Furthermore, having team members who at some point developed specific parts of the car is excellent to ensure that the know-how within the team is not lost.

I would like to express deep gratitude to our alumni who were part of this first attempt."

> - Afonso Costa **FS FEUP Team Leader**



WHAT'S NEXT?

Manufacturing an Electric prototype as a first-time Formula Student team can be an exciting but challenging task. There are several challenges that we encountered during the process, mainly because Electric vehicles require a different set of skills and knowledge than traditional combustion engine vehicles.

The team is rising to the occasion and is balancing the whole different layers of the necessary manufacturing subsystems of the prototype. But getting to the core of the question: What's next?

Obviously, the Chassis painting, Powertrain and suspension assemblies are the main objectives but our team what to go a bit further and ensure a strong testing and validation the vehicle. With limited resources and time, we must guarantee an extensive testing to ensure their safety, reliability, and performance.

Therefore, we are planning a rigorous testing schedule to identi-

fy and address any issues before the competition.

In conclusion, manufacturing an electric prototype as a first-time Formula Student team can be a challenging but rewarding experience. See you next time with our prototype assembled!



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