

# Lafayette College 2020-2021 FSAE Team

## Interim Progress Report

### 1. Scope:

Our project plan for completing an “on-paper” car was mostly fulfilled last semester. On the mechanical hardware end, inventor models and drawings of pieces such as the chassis, suspension, steering, brakes, drivetrain and cooling have all been completed and set into an entire car inventor model. Electrical subsystems such as the battery packs, car manager, and dashboard, have also been added to this model to make it a complete vision of our car. These drawings are now being sent into our school’s shop to be manufactured and to start piecing together the car. For electrical hardware, all PCBs that we needed to create were created in KiCAD and sent for manufacturing. In addition to this all parts have been ordered to piece these together for this semester. Our “on-paper” goals of completing design for manufacturing and purchasing have been met over the break and we are on track to start piecing the subsystems together for the car. Software for our supervisory and control data acquisition system was also mostly completed up unto testing with the subsystems.

Some areas of the project we fell short on last semester include overall test plans, a safety plan, website management, as well as software for the battery packs system management. Our overall test plans for the entire car as well as the safety plans were included in the on-paper portion of the semester and they were not complete by the ended of the semester due to starting them too late, after the majority focus of design. These are now being worked on for completion at the beginning of this semester and lab work. Website management was neglected as it is our goal to update all documentation for the entire team to reference there. This was remedied over the break and updated with the necessary materials. The battery packs were listed as a problem area last semester and continue to be one. The software related to the packs was not completed as something that could be done remotely. Management addressed the team about this during our first meeting and will be making necessary changes.

The current project plan for the second semester starts with the completion of all parts acquirement. This is such that the subsystems can begin manufacturing their own parts and then test them according to the test plans laid out. This completion date is about 3 weeks from our first meeting and after that we plan to piece together the car for overall testing and analyzing. This schedule will be talked about more in the next section, however the overarching goal for this semester is to build a functional electric car by the end of the semester.

### 2. Operations:

Our initial schedule needed to be changed according to the new school schedule that was released prior to the break. We moved all dates back two weeks according to the initial schedule. This updated schedule can be seen in Appendix A. This schedule is mainly focused on car manufacturing however does include key documentation dates for both the competition and the class.

The team is currently slightly behind schedule in terms of some documentation and software as mentioned before. However, this can be easily remedied by putting a focus on it at the beginning of the semester and pushing to complete what we aimed to do last semester and over the break. Graphical representations of our progress is present in Appendix D.

Some major accomplishments completed last semester and over break included numerous initial purchase requests made after design of subsystems was analyzed and approved. A list of these can be found in Appendix B. Another accomplishment was the completion of the car design, including PCBs and inventor models, all of which were instrumental in continuing manufacturing and production of the car for the beginning of the semester. Some images of these can be found in Appendix C.

### **3. Risk Management:**

Progress on high risk tasks is proceeding somewhat behind schedule, as we are in the process of developing a new contingency plan for working with high voltage battery packs. Our intent is to add a high visibility display that demonstrates which of many discrete states the battery packs are in. These states will then correspond to ways that those high voltage accumulators are handled by the team, or interacted with otherwise. Other high risk activities are being managed in the same way as previous years, and are on schedule for completion in accordance with our schedule.

### **4. Expected Results:**

Compared to our goal progress of being 50% complete before the interim, and 57% complete afterwards, we achieved 37% completion before the interim and 43% completion after the interim period. See Appendix D for graphical representation of our progress.

One of the major barriers we have encountered is the setbacks caused by inheriting significant amounts of untested parts to construct the two accumulator packs that we plan to use. This setback was compounded by our lack of manpower placed on the battery packs team, which has since been addressed through our change management process. Moving forward we do not foresee any other significant barriers at the moment, however we are realistic in our view that more barriers to our progress will arise that we cannot foresee.

### **5. Change Management Process:**

The only change request made over the course of the interim period was the reallocation of more personnel to the Battery packs team. We approved this change request within a week of the concern being brought to the attention of the management team. This process was started when we realized that the area of greatest concern for achieving the deadlines set forth in our schedule and work breakdown structure was the construction and testing of our accumulator system. By allocating more personnel to this process, we hope to speed up the process of developing and testing our accumulators, while also preventing further delays based on how other systems rely on the accumulators to function. Given the successful change, we felt no need to revise our change management process.

## Appendix A: Spring Semester Schedule

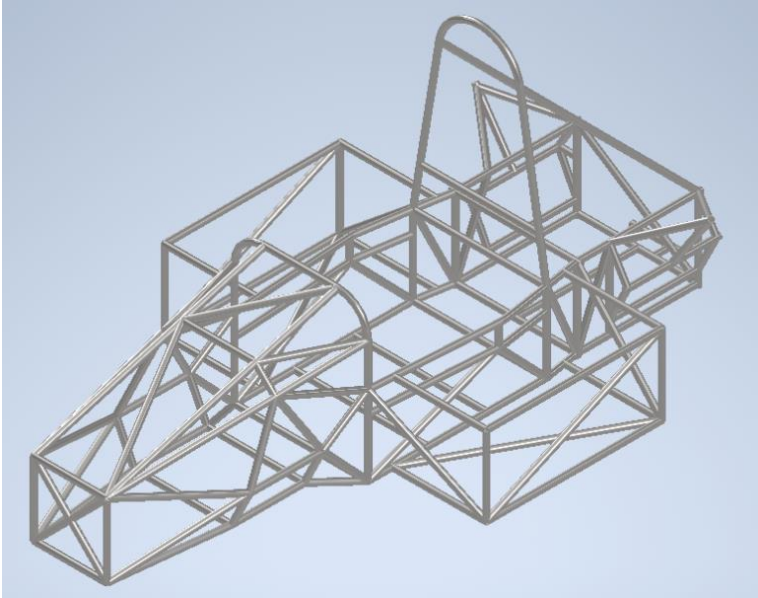
Spring Semester Schedule	
Date	Description
2/7/21	ESF-2 Early Submission
2/8/21	Impact Attenuator Data
2/8/21	TD014-015 Lab & On-Road Test Plans
2/8/21	TD003 Safety Plan
<b>2/12/21</b>	<b>Today</b>
2/15/21	All Initial Purchasing Completed
2/15/21	FSAE Interim Project Report
2/19/21	All Initial Machine Shop Orders Completed
2/19/21	All Subsystem Level Test Plans Completed
2/20/21 -3/5/21	Manufacturing and Testing of Subsystems
<b>3/5/21 (3 Weeks)</b>	<b>All Subsystems Completed and Tested</b>
3/12/21	All Mechanical Subsystems on Chassis
3/12/21	All Electrical Subsystems in Dyno Room
3/13/21-3/26/21	Testing and Debugging of Entire Electrical System
3/13/21-3/19/21	Testing of Rolling Chassis
<b>3/19/21 (5 Weeks)</b>	<b>Rolling Chassis Completed</b>
3/22/21	Design Report
3/22/21	Sustainability Report
3/22/21	Design Specifications Sheet
3/26/21	TD009 Spring Update Report
<b>3/26/21 (6 Weeks)</b>	<b>Dyno Integration</b>

3/27/21	Spring Break (ECD)
<b>4/9/21</b>	<b>Electrical System Installed on Car</b>
4/9/21-5/19/21	Car Testing
5/19/21	TD018-021
<b>5/19/21</b>	<b>End of Classes</b>

## Appendix B: Purchase Requests

PO #	PO Submittal Date	Vendor	Subsystem(s)	CURRENT STATUS
001	10/4/2020	Amazon	Drivetrain	RECIEVED
002	10/4/2020	Adafruit	SCADA	RECIEVED
003	10/6/2020	USPlasticCorp	Cooling	CANCELLED
004	10/20/2020	RevShift	Drivetrain	APPROVED
005	11/25/2020	PlumbingSupply	Cooling	RECIEVED
006	12/1/2020	Amazon	Cooling	APPROVED
007	1/4/2021	VR3	Frame	APPROVED
008	1/19/2021	McMaster	Drivetrain	RECIEVED
009	1/26/2021	JLCPCB	EPAL	RECIEVED
010	2/10/2021	JLCPCB	Carman	APPROVED
011	2/10/2021	Digikey	Carman/EPAL	APPROVED
012	2/10/2021	Mouser	Carman/EPAL/Interconnect	APPROVED
013	2/9/2021	McMaster Carr	EPAL	APPROVED
014	2/8/2021	Amazon	Interconnect	APPROVED

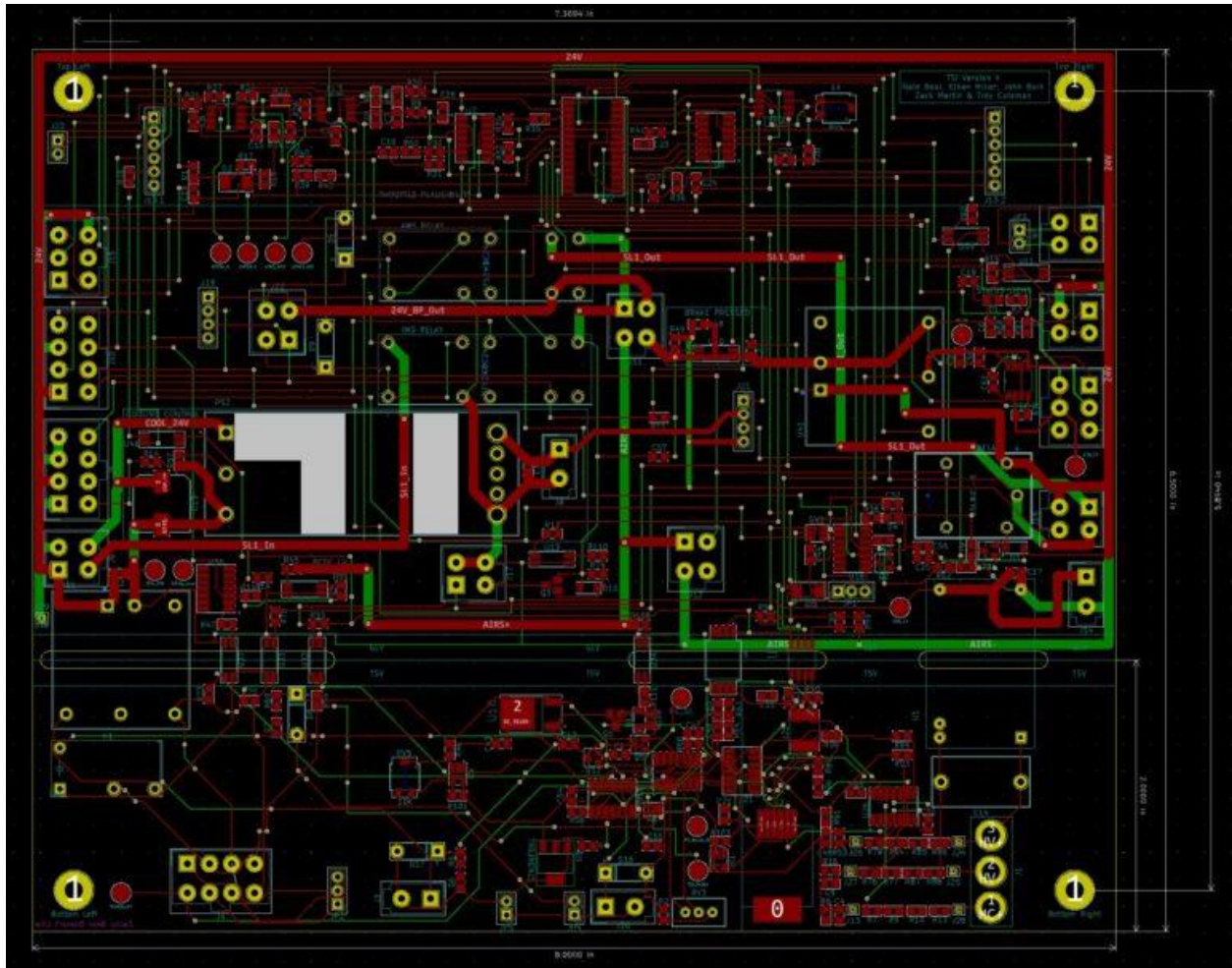
**Appendix C: PCBs & Inventor Models**



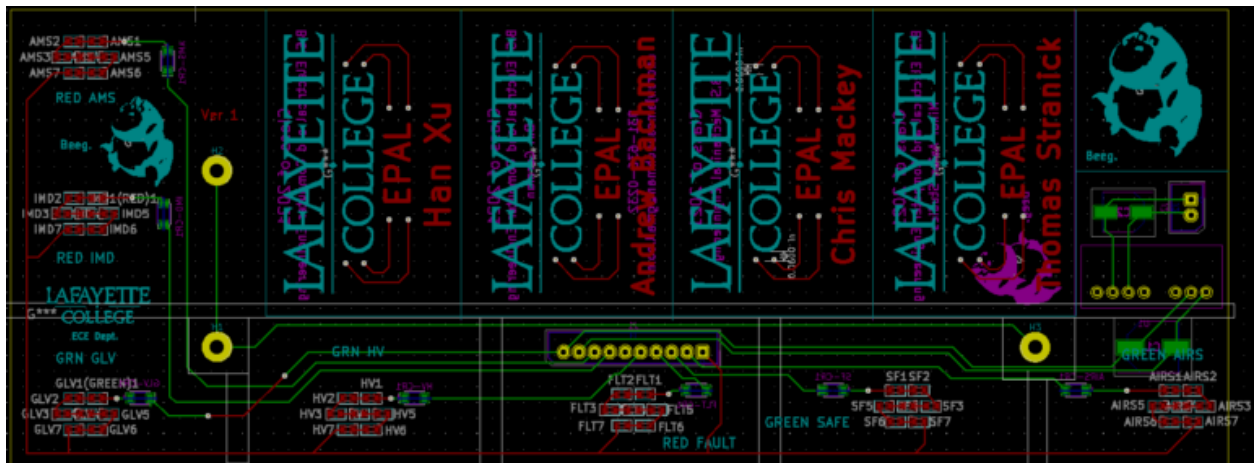
Frame Inventor Model



Right & Left Side Panels Inventor

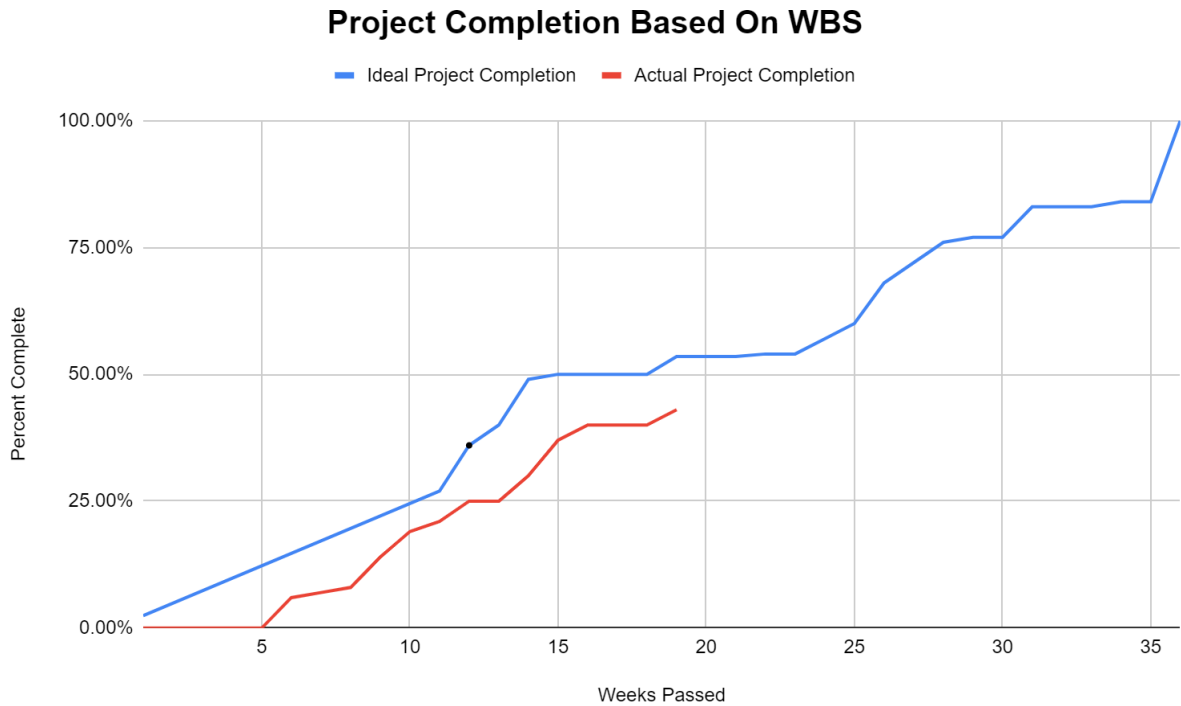


TSI (Tractive System Interface) PCB

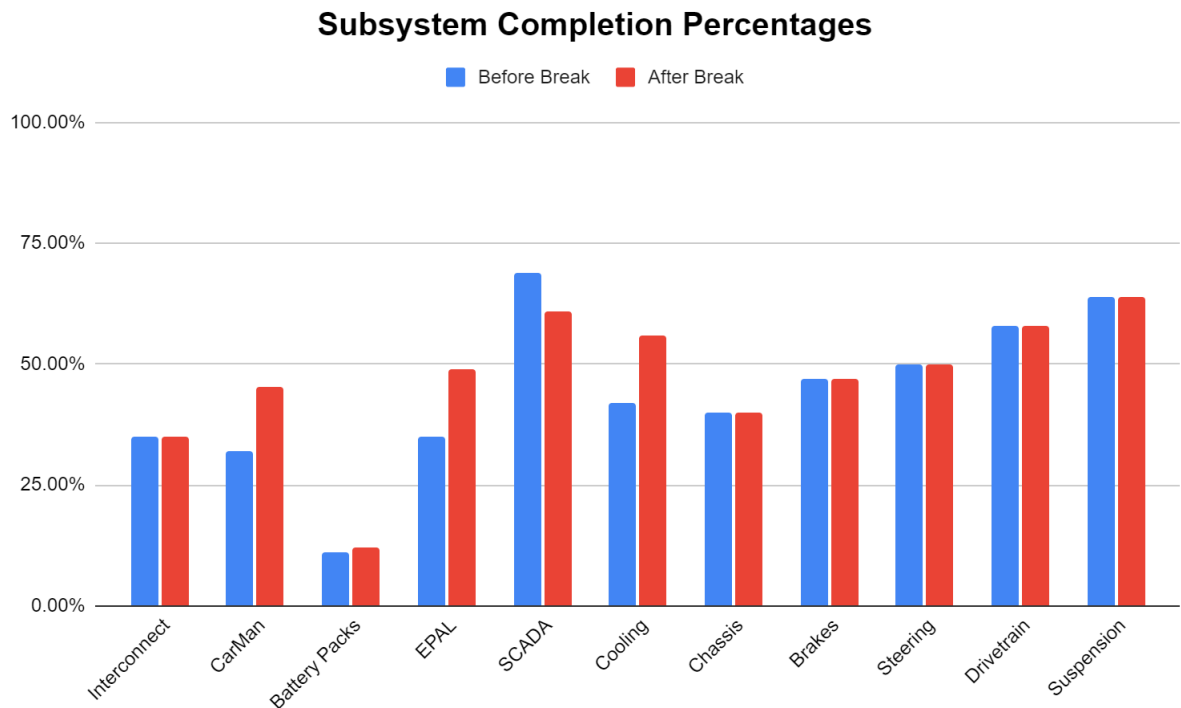


Dashboard PC

## Appendix D: Graphical depiction of project progress metrics



Project Completion Percentage vs Time



Subsystem Progress Before and After the Interim