

**Supplemental Rear Wheel Power Steering System for a FSAE Vehicle**  
(Technical Report)

**COVID-19 and F1 Sponsorship**  
(STS Research Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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## **Introduction**

“The car is perhaps the most successful innovation ever, spreading all over the world it seems, despite well – known backsides to this success” (Bladh, 2019). This form of transportation enabled people to travel farther than ever before and in shorter periods as well, promoting the growth of tourism and related industries such as gas stations and motels. “The automotive tourism movement occurred within a wider context of increased road-building, the emergence of paid vacations, and a general climate that fostered the “urge to travel” at the local, state, and federal levels” (Mom, 2014). As cars became more common, the development of roads and traffic signaling devices grew with increasing urbanization. To this day, automobile ownership is nearly universal with cheaper, streamlined production. What was once only used out of necessity and privilege is now more accessible and affords people the opportunity for leisure travel.

## **Developing a Rear Power Steering System for use in a Formula – Style Vehicle**

For the technical project, I was part of a capstone team composed of members of Virginia Motorsports, a student organization that promotes experiential learning by producing vehicles to enter collegiate design series competitions. One of these is Formula Society of Automotive Engineers (FSAE) where students develop Formula-style race cars and compete in static (presentation, cost, design) and dynamic (acceleration, skid pad, autocross, endurance, efficiency) events. The static events evaluate the ability of the team to develop an effective investment proposal, consider budget during production of the vehicle, and incorporate good engineering practice in terms of vehicle performance and overall value. The dynamic events evaluate vehicle acceleration in a straight line, cornering ability while making a constant radius turn, maneuverability and handling qualities on a tight course, performance in terms of durability

and reliability, and fuel or energy used during the endurance event. The previous semester, we intended to enter the competition with a car we had begun to build since Fall 2019 but that was cancelled due to COVID-19. This school year, we plan to enter FSAE again and work on a subsystem of the car for our capstone project. When considering our options, we wanted to do something to supplement the current car. Thus, the team decided to incorporate an electronic rear wheel power steering system as the car is currently only able to utilize front wheel steering through rack and pinion. According to the rules, the front wheels are required to use a rigid mechanical linkage but the rear wheels may be electrically actuated with mechanical stops. This would improve the handling of the car so as to reduce driver fatigue while increasing steering response (Thompson, 2020). Consideration for comfort is important as drivers can experience “literal exhaustion of the deltoid muscles associated with the dynamics of moving the steering wheel” (Ferguson, 2018). We will research rear wheel steering before designing the hardware to be used and modeling the controls. Afterwards, we will manufacture the system and validate the models before physically testing the car. We plan to have a finished design by the end of the semester and then begin manufacturing and tuning the system once we return from winter break.

### **COVID-19 and F1 Sponsorship**

Motorsport encompasses all motor vehicle competitions. A major distinction among the competitions is whether the vehicle has open wheels or they are enclosed. The former includes single seater series such as Formula racing (there are different classes of competition; an electric class is a recent addition) and the IndyCar series that is based in the US. The latter includes stock car racing with the National Association of Stock Car Auto Racing (NASCAR) and sports car racing with the World Endurance Championship (WEC). For two – wheeled vehicles, there is motorcycle racing whether it is off road or on road. The most popular motorsport is Formula 1

(F1), the highest class of Formula racing where teams “have grown into multi – million dollar – generating businesses, with staffing levels in the hundreds and, in some cases, thousands” (Stuart, 2020). It boasts hundreds of millions of viewers, expensive team budgets as well as contributing many technological innovations such as active suspension and aerodynamics. These achievements were not made on the efforts of the teams alone. “The great expense of teams, vehicles, and equipment makes sponsorship essential. The teams and companies alike benefit from ... advertisements, both financially and symbolically: the better teams attract the better brands, providing a reciprocal boost to each party’s marketplace desirability ranking” (Traber, 2018). The appeal of investment lies in the desire to take part in success. “The industry’s quiet professionalism and earnest passion for technical skill accepts this glamour of the spectacle as part of its history and its future as a business in the attraction of corporate sponsors” (Nichols et al., 2017). Due to Covid, F1 had to rework itself in order to follow safety regulations, from decreasing the number of grand prix races and spectators to social distancing. In response to safety interventions, operations have been scaled back. This report will analyze the threat of Covid to sponsorship in F1.

## **Conclusion**

As the most dominant form of transportation, the automobile has impacted society, influencing culture as well as politics. The technical portion consists of designing a better steering system for a Formula car by incorporating electronic controls into an already mechanically actuated system. The STS portion focuses on the future of F1’s existing business model against the backdrop of COVID.

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