

Thesis Project Portfolio

Optimization of a Formula SAE Vehicle Intake Manifold

(Technical Report)

The Need for Nuclear Energy and Ensuring Accountability

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

My Mechanical Engineering capstone project focused on optimizing the intake system of the University of Virginia's (UVA) 2023 Formula Society of Automotive Engineers (FSAE) vehicle intended to compete in the Formula SAE competition in Brooklyn, Michigan in May 2023. The intake system includes three main components: Restrictor, Plenum, Runners. Goals included decreasing the weight of the system, increasing engine horsepower, and improving fuel efficiency. My capstone group went through design constraint screening and scoring over 12 potential intake designs which were completed in the first half of the Fall 2022 semester before focusing on one design. This is UVA's FSAE team's third year of competition and improving the functionality of the intake system can help propel the team to a higher overall ranking at the Michigan competition.

My capstone group went through extensive research and development of the intake system in the Fall 2022 semester while manufacturing components in the Spring 2023 semester. In the Fall, multiple designs of each component were created on Fusion 360 and went through numerous computation fluids dynamics (CFD) and vibrational analysis simulations to adjust each part's designs and wall thicknesses. 3D-printers and a computer numerical control (CNC) milling machine were used to manufacture the intake components. This vehicle runs on a 600 cubic centimeter (cc) motorcycle internal combustion engine (ICE) and the UVA team is hoping to transition to an electric Formula SAE car within the next few years. It is important to consider the impact that ICE vehicles and the use of fossil fuels have on the environment. Switching to an electric vehicle will have a positive impact on the environment in addition to giving UVA students an opportunity to enter the workforce with electric vehicle experience.

My STS research discusses the need to transition away from a majority fossil fuel source of energy and to nuclear which is much cleaner and sustainable for the environment. Additionally, my research discusses the need for accountability in nuclear disasters. Actor-network-theory (ANT) is used to explore the relationships between the various people and objects involved in producing, regulating, and obtaining nuclear energy. The social construction of technology (SCOT) also explores the technology that safeguards nuclear energy. By exploring the impacts of the Chernobyl nuclear disaster of 1986, the actions of the Soviet Union can be shown to have negatively impacted residents in the area. I expect to discuss the flaws in the reaction to the disaster by the Soviets and how the entire world was needed to help impacted residents. My capstone project and STS research have similar themes of positively impacting the environment and transitioning to more sustainable sources of energy: electricity for cars and nuclear for power.