**Design and Optimisation of a Supersonic Sounding Rocket**

(Technical Project)

**The Technological Benefits of War on Society**

(STS Research Paper)

A Thesis Prospectus in STS 4500 Presented to The Faculty of the School of Engineering and Applied Science University of Virginia, in Partial Fulfilment of the Requirements for the Degree Bachelor of Science in Aerospace Engineering

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On my honour as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honour Guidelines for Thesis-Related Assignments.

*Please note that the entire class of MAE 4690/4700-002 is working on this project, I am listing my groupmates for our sub-team within the project.

**Technical Introduction**

The technical project is separate to the research undertaken for the paper and is based on the capstone project I am undertaking: to design a supersonic sounding rocket. Sounding rockets' value is increasing rapidly with the growth of the private sector in rocketry, as they allow firms to easily test parts without launching a full sized space rocket, or giving users the ability to quickly and cheaply gather data – this is commonly seen within environmental engineering companies.

I am working within a sub-group whose main focus is to design, optimise and manufacture the nose cone for the rocket; the entire team of roughly 30 students aims to manufacture, test and launch a working rocket from scratch, with three main teams of (i) Aero-Structures, (ii) Mechatronics & Payload and (iii) Propulsion. Through the project I will learn specifically the manufacturing methods used to craft carbon-fibre-reinforced-polymer (CFRP) parts, how to safely attach them to different materials and how to test airflow around a body. There may also be a requirement to weld parts, this is also a skill to be learned.

During the course we are not only learning about rocketry in a hands-on manner, but also developing teamwork and project management skills as will be useful for the professional world. From my experience in summer internships at engineering companies, the course is structured similarly to how a project would be undertaken to complete a contract. Examples of team wide tasks include communication regarding deadlines, submitting purchase proposals and presenting our work to a larger team.

Within the class we have deadlines to ensure each team is making steady progress; In the fall semester:  a Design Specification Review on 27 October and Preliminary Design Review due December 5. In the spring, a Critical Design Review and Final Design Review will both be completed, with the ultimate goal being to manufacture the rocket alongside completing these milestones. This will depend on our ability as a full team to provide an adequately detailed

Preliminary Design Review and create a scale model by the end of the semester, as well as Professor Dong's ability to requisition some additional funding from the School of Engineering and Applied Science.

**STS Research Introduction**

My paper will discuss the benefits brought about by the technological arms races during wars, with a particular focus on the world wars due to the plethora of examples and the detailed history given the recency of these events. I will also be using these examples as case studies to provide strong arguments in favour of the socio-technical framework of Technological Determinism; the notion that one of the major driving factors behind social change is technology. A classic example being the extreme change brought about by the invention of automobiles, not only creating a significantly faster mode of transport but also requiring re-worked urban layouts to account for safe pedestrian access. Specifically, I will be discussing how technologies that are created during wartime (initially with the purpose of losing fewer soldiers, increasing firepower, and ultimately winning the war) are often used post war in common ways that we often do not realise. A few notable examples include: the microwave (formerly, *Cavity Magnetron*, used as a portable radar), nuclear power (*Fat Man* and *Little Boy*) and the computer (John Mauchly's *ENIAC*). These are just a few of a plethora of examples I have come across during my research; I will also discuss how war may affect distribution or production of a technology or item – which I consider to be technologies in itself.

The STS Research paper draws on a potentially controversial topic, yet a topic I feel somewhat close to, given the nature of many Aerospace Engineering professions within the United States, particularly a job I will likely have after graduation. It is also inspired by the song *Father* by the Swedish power-metal band Sabaton; this link will be discussed further in

the paper. It is clear to me that while war has the severe detrimental consequences we commonly discuss, the technological benefits seen – most clearly seen during both world wars – have certainly helped society on the global scale. It is important to note that I am will not be analysing whether these benefits outweigh the negative consequences, as this will open up an entirely new ethical discussion into the price of a life. While these cases of technological improvements provide strong evidence for the theory of technological determinism, it does have some shortcomings – most notably that it is a one-way theory, failing to explore the social factors impacting technological change. These cavities in the theory will also be discussed in the paper.

**Citations**


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