

Thesis Project Portfolio

HEDGE: Hypersonic reEntry Deployable Glider Experiment

(Technical Report)

Inherent and Use Politics: An Analysis of Hypersonics Technology and Its Development

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

Nicholas Haddad

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Department of Engineering and Society

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Sociotechnical Synthesis

My technical work and my STS research both focus on the idea of hypersonics technology and its development. Hypersonics is the field of aerodynamics dealing with speeds that exceed five times the speed of sound, or Mach 5 and above. Both my works, with hypersonics being the central idea, differ in their exploration and research. For my technical work, the goal was to determine whether or not it was feasible to use CubeSats, miniature satellite projects for universities and students, to research hypersonics. My STS research, however, focuses on the characterization of hypersonics in global politics and the effects it has on the United States. Although they explore the topic in different way, however, they both highlight the extensiveness of hypersonics and its prevalence in the global future.

My technical project, deemed the Hypersonic reEntry Deployable Glider Experiment (HEDGE), tries to answer the question of whether or not it is feasible for university students to perform hypersonic glider flight research affordably. To do so, we used a type of miniature satellite called a CubeSat to be launched in 2025 aboard a third-party launch provider. The purpose of this satellite would be to reconfigure itself from its 30x10x10 cm box shape to a pointed, missile-like profile. Upon orbiting the Earth for between 1-2 weeks, the satellite would then reenter the atmosphere at close to Mach 20 to then send back data to a ground station before completely burning up. If successful in all of these goals, we would then conclude that it is feasible for students to affordably do their own hypersonics research. Our hope is to demonstrate that governments and large defense companies aren't the only ones that can successfully research hypersonics, and that universities can do so relatively inexpensively without large funding.

My STS paper, on the other hand, takes a different approach to hypersonics technology. I wanted to describe how the field of hypersonics creates an entirely new political climate.

Hypersonics has an impact both domestically and internationally, and they can be characterized in several ways with Langdon Winner's idea of inherent versus use politics. The first describes how hypersonics technology is directly used. They are virtually-untraceable missiles that the United States lacks knowledge of in comparison to foreign enemies, like Russia and China, creating a looming fear for U.S. global superiority. The second idea set forth by Winner characterizes the United States' response to this threat. Hypersonic weaponry represents that the U.S. is falling behind its foreign counterparts, and so the U.S. has created this propaganda tool around students joining the STEM field. The general idea is that the government is pushing students to join STEM majors to help the world be healthier or safer for everyone, but in reality, it is so that they funnel into defense contractors to further advanced weaponry research. The goal of my STS paper is to further describe both of Winner's ideas in the context of hypersonics and the implications that they have.

Working on this research simultaneously the past year has greatly increased by enthusiasm for this field. As a STEM major growing up in the early 21st century, it was difficult to consider ever the ethics behind the science I was so interested in. It was always idolized in my eyes. My technical project was exactly the type of work that I always felt I would be doing in college or even my career. This STS research was exactly what I needed to see my work from a completely other approach. I feel that this paper has enabled me to understand the connection between global issues and a changing workplace, hopefully giving me the hindsight to be careful when choosing the right career path for myself. Both my STS research and my technical project have given me an appreciation for the field of hypersonics, and I am confident that writing both simultaneously contributed to higher quality for both works.