

## **Thesis Project Portfolio**

**Hypersonic ReEntry Deployable Glider Experiment** (Technical Report)

**The Role of Undergraduate Aerospace Research in University, Industry, and Government  
Relations** (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

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While the subject matter of my technical project is mentioned in my STS research, it really is the act of me performing a technical capstone project that ties in best. My STS research project examines how mandatory unpaid research in undergraduate aerospace engineering curriculum came to be and how it was shaped and how it affected the relationships between universities, industry, and government as it pertains to aerospace. By completing my technical capstone, I am part of the system that my STS research explores. The content of my technical project, CubeSats, is also relevant to my STS project as CubeSat projects are a common way universities engage undergraduate aerospace students in research.

My technical report is titled *Hypersonic ReEntry Deployable Glide Experiment*, more commonly referred to as HEDGE, which is a continuation of a mission started by previous sections of the Spacecraft Design course. The primary objectives of HEDGE are to show that CubeSats are a viable platform for conducting hypersonic glider research and to transmit data about hypersonic re-entry conditions to an Iridium satellite. The mission's current concept of operations includes adding our CubeSat to the payload of a Northrop Grumman Antares rocket, which will insert the CubeSat into a low earth orbit (LEO). Once the CubeSat has been released from the rocket, it will deploy fins, effectively morphing from a 3U CubeSat into a hypersonic glide vehicle. From that point, it will continue traveling in a LEO until naturally deorbiting and re-entering the atmosphere where it will collect flight condition data until a total burnup has occurred. As part of the Power, Thermal, and Environment team, I ran simulations testing the

model under the conditions it would experience during launch and determined that HEDGE would survive launch and would be able to start performing its mission objectives.

My STS research paper is titled *The Role of Undergraduate Aerospace Research I University, Industry, and Government Relations*. My research aimed to tackle the question of “Why don’t undergraduate aerospace researchers get paid for their work?”. Using infrastructures as my sociotechnical framework, I analyze how the system of mandatory unpaid research in aerospace curriculum came to be and what existing structures it was built off of that shaped it. I discovered that in the 1990’s and early 2000’s there was a lack of skills in university graduates and industry could not find enough qualified workers to fill their open positions. By working off the preestablished relationship between universities and industry, in which universities supply graduates to keep up with industry labor demands, it fell to the universities to change their curriculum so that their graduates had the proper skills that industry was looking for. Industry supported this change with financial assistance to the universities, such as grants and sponsorship of facilities and programs. I also found that the federal government had been aware of this decline in U.S. aerospace as early as the late 1980’s and found it imperative that it reverse the decline and bolster the industry so that American aerospace was still the leader globally. They did this by passing legislature that allowed for the establishment of grants to universities, such as the Virginia Space Grant Consortium, which funds aerospace research today at the high school and undergraduate level. Analyzing this research led me to the conclusion that students aren’t paid for their work as researchers, because having mandatory research was never supposed to benefit the student, only to meet the demands of industry and government. Any other benefits that may come to the student, such as getting a high paying job, are merely a product of shared goals between students and one of the other players in the system.

These were very interesting projects to complete at the same time, not many other students have a STS project that might paint their technical project in a negative light. By having first hand experience of the system I explored with my STS research, I was really able to confirm all my findings and come to a solid conclusion. My STS project made me question more of what I had be mindlessly participating in because it was required for my degree. That fact that I was forced to do research to graduate isn't necessarily a bad thing, and I will reap some benefits from it, but understanding that my peers and I were not truly the intended recipients of what we learn in our capstone class makes me think differently about the whole of my aerospace education. What I've learned certainly won't make me not join the aerospace industry, but it will make me approach things with a different attitude, and be more proactive about doing things that benefit me, because it won't happen naturally with the system as it stands now.