

Thesis Project Portfolio

HEDGE: Hypersonic ReEntry Deployable Glider Experiment Critical Design

(Technical Report)

Hypersonic Technology Research and Development at Universities

(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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Spring, 2023

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Sociotechnical Synthesis

The introduction of hypersonic weapons, which fly at greater than five times the speed of sound, has sparked a new arm's race in the 21st century. While this technology is still mostly in its research and development phase in the United States, its major adversaries have already fielded hypersonic missiles. The US has not been able to conduct many flight tests and collect real experimental data due to the high cost of testing, which is slowing down the development of this technology.

The technological solution to this problem is a low-cost method for hypersonic flight experiments. The Hypersonic Re-Entry Deployable Glider Experiment (HEDGE), is a mission involving a small spacecraft which will launch into extreme low Earth orbit and re-enter into the atmosphere at hypersonic speed. The form factor of the spacecraft follows the CubeSat standard, which is a class of miniature satellites based around small cubes which are simplistic and affordable.

While this technology is purposed towards civil applications, the procedures, models, and results from this technology can still be applicable towards larger-scale hypersonic weapons. Several large defense contractors and the US Navy have expressed interest in HEDGE and have contributed to the development of this technology through funding. These grants are a financial incentive to universities to host hypersonic programs, which ultimately support DOD hypersonic programs.

The STS framework which is applicable to analyze the dual-purpose nature of hypersonic technology is techno-politics. HEDGE is an inherently political technology because it may be

used to aid the development of technology which promotes power and authority for certain groups while oppressing and killing others.

In order to determine the extent of government influence on hypersonic research at universities, a case study will be performed on the UVA Hypersonic Research Complex to analyze the relationship between the government and hypersonic research at universities. Additionally, interviews of aerospace engineering students from different universities will be conducted to determine personal views on government influence.

As a result of successful research, there should be clear evidence of government involvement with hypersonic programs at universities. The relationship between government and university may be mutually beneficial, as universities receive funding to educate students through research projects closely aligned with future career paths while the government will receive both technical and human resources in the form of trained engineers who will aid the US in closing the technological gap with its adversaries.

Understanding the relationship between the government and universities is crucial to optimizing the benefits of both parties. Universities can redirect their educational efforts to increase student engagement with defense-related research and increase the amount of funding, while the government can increase the efficiency of research conducted and better train upcoming engineers.