

Thesis Project Portfolio

Hypersonic ReEntry Deployable Glider Experiment (HEDGE)

(Technical Report)

A Study of Prime Defense Contractor Consolidation since the 1990s and its Effects

(STS Research Paper)

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Sociotechnical Synthesis

Hypersonic ReEntry Deployable Glider Experiment, or HEDGE for short, is a concept developed over the course of multiple academic years as a capstone design class for mechanical and aerospace engineering majors. Hypersonic flight generally denotes that at a speed of Mach 5 or greater, meaning at least five times the speed of sound. This has been an area of intense interest and research in recent years for its applications to national defense and due to the abundance of technical challenges inherent in that kind of speed. The HEDGE project at UVA aims to give undergraduate students experience in the multidisciplinary field of hypersonics, and ultimately prove that these students are capable of developing a useful test vehicle for components in a hypersonic flight regime at a low cost.

HEDGE is a CubeSat, which are small satellites using mostly commercial off-the-shelf (COTS) parts, launched generally as secondary payloads on orbital missions. HEDGE is designed to be launched in a folded configuration that will expand into its flight glider configuration upon expulsion from a standard CubeSat launcher. HEDGE is designed to be equipped with a GPS receiver, pressure transducers, and thermocouples and will send data collected from these sensors, via the Iridium satellite constellation, to a ground station at UVA. The government or other research entities will provide the HEDGE team with material panels to be tested in hypersonic conditions from which flight and temperature data could be used to inform necessary changes or future milestones for a given material candidate.

The military-industrial complex is the system of systems that encompasses the United States military, its federal regulators, and its private suppliers. Since the end of the Cold War, the number of these suppliers, or defense contractors, has decreased drastically. The anticipation of a large cut to federal defense spending led to the conclusion that the military industrial base would

be too large to support in a post-Cold War society. What was once a lively, competitive market to supply the U.S. military with everything from fighter jets to aircraft carriers, has been reduced to one with few options for the military to choose from. These remaining contractors (Lockheed Martin, Boeing, Raytheon (RTX), General Dynamics, and Northrup Grumman) have accumulated immense market share and power.

I show that a key driver of this change was a secret meeting in the Pentagon in 1993 that set off a flurry of contractor mergers and acquisitions, which has ultimately created the problems we see in the military industrial base today. The military is often overcharged, innovation has slowed down, and there is a revolving door between these powerful corporations and the top levels of government. This impacts more than just the readiness and capability of our military. The government paying more for essential defense capabilities means that money has to be either taken from other government programs, taxes must be raised, or the national debt must grow. Additionally, cutting-edge research is often done initially for application to defense before that innovation ultimately trickles down to regular citizens, improving quality of life.

While HEDGE is a much different project than Lockheed Martin designing a new aircraft for the Department of Defense, our class is acting similarly to a defense contractor. HEDGE will likely be funded by some organization under the umbrella of the DoD, and will need to conform to requirements that are set in the same way that a large corporate entity would. Additionally, HEDGE has been an introduction for undergraduates into many methods and practices of the DoD and the way contractors interact with their customer. We have prepared detailed budgets, risk analysis, schedules, models, and reports. Additionally, we have pitched the project to representatives from industry and the Navy.