

Thesis Project Portfolio

Hypersonic ReEntry Deployable Glider Experiment (HEDGE)

(Technical Report)

An Ethical Analysis of China's 2007 Anti-Satellite Test and Implementation of Such Weapons Utilizing Just War Theory

(STS Research Paper)

An Undergraduate Thesis

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Bachelor of Science, School of Engineering

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Sociotechnical Synthesis

My technical work and STS research are connected primarily by their roles in conducting research, development and testing through the space domain. However, the two works differ on how space is utilized for testing new technologies and their impacts. My technical work furthers the goal of demonstrating low-cost solutions to hypersonic and national security related research using CubeSat technology, whereas my STS research explores the consequences of anti-satellite testing. While my technical work and STS research seem disconnected in their topics, the theme of experimental testing through the space domain and the implications on technological developments are consistent across both works.

My technical project continues the work on a hypersonic glider experiment with the goal to demonstrate a low-cost CubeSat proof-of-concept that undergraduate university students can develop to support national security interests. Hypersonics research has been a serious national security interest to the United States Government in recent decades due to the advancements China and Russia have made in this field. This CubeSat experiment relies on atmospheric reentry to conduct its mission. While in the reentry phase of the mission, the spacecraft will relay various physics measurements that it will experience at hypersonic conditions before burning up in the atmosphere. My capstone team has continued to develop the spacecraft design initiated by previous years capstone teams. Our project culminated in a final design review that will allow for the future capstone team to begin manufacturing a prototype once funding is available.

My STS research explores the consequences involved with testing and implementing kinetic anti-satellite (ASAT) weapons. Specifically, my research focuses on China's 2007 kinetic ASAT test against the Fengyun-1C, a defunct Chinese weather satellite. I utilize Just War Theory supported through a utilitarian foundation to develop my analysis on utilizing these weapons systems. My claim is that China's ASAT test and the use of these weapons is unethical as it

disproportionately effects the civilian population. My analysis explores how the space domain is utilized by the civilian population, and how access to it is critical to maintain modern society today as we know it. The goal of my research is to stimulate debate on the peaceful use of outer space and shed more light on the unintended consequences to civilians that ASAT weapons pose.

Working on these two projects gave me a further understanding in their respective topics. My technical work gave me a further understanding of the CubeSat acquisition and development process, and how to approach it as a program manager. The research I conducted for the STS paper helped me understand how critically important access to the space domain is for civilians, and how it is important that governments act responsibly in space by not deliberately creating debris. Even though my technical project and STS research have no substantial overlap, working on both simultaneously gave me a deeper understanding of the astronautics field and the developing geopolitics that are involved.