Thesis Project Portfolio

HEDGE: Hypersonic ReEntry Deployable Glider Experiment

(Technical Report)

The Price Paid by Pacific-Indigenous Islander Nations for Science

(STS Research Thesis)

An Undergraduate Thesis submitted to the Department of Engineering and Society

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Executive Summary

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HEDGE: Hypersonic ReEntry Deployable Glider Experiment

The United States is one of the most prominent nations who is targeting a means to secure its status as a world power through the advent of a novel form of technology: hypersonic flight. The predominant applications for hypersonic flight technologies lies within the realm of the military industrial complex, with potential non-conflict applications being pursued as a side-effect of this new technology. Military applications of hypersonics include, but are not limited to, hypersonic missiles, flight vehicles, and missile defense systems. The HEDGE initiative seeks to utilize a CubeSat platform to conduct test flights at hypersonics speeds within extreme low Earth Orbit (ELEO). A CubeSat is a standardized platform in which a satellite is constricted to prescribed cubic dimensions as a means to facilitate construction and experimentation with universally manufactured parts. Ordinarily, hypersonic flight tests conducted within military and defense organizations will cost upwards of 200 million dollars per launch. Hypersonic flight tests with this CubeSat platform are meant to demonstrate that extremely low cost hypersonic research is viable using these methods and processes.

HEDGE serves a dual purpose in both demonstrating the feasibility of hypersonic flight tests with low-cost CubeSats and in training undergraduate engineers with the skill sets necessary to develop and interface with hypersonic technologies. As it stands, HEDGE is currently in the process of receiving a critical design review, which is a stringent standard of evaluation in which a project is deemed ready for final assembly and fabrication. In order to successfully pass a critical design review, the project must be sophisticated enough to be fully assembled with the materials and research that the design team has provided. The undergraduate design team must adhere to guidelines and regulations put forth by both the U.S. government and NASA in order to receive funding and approval to continue with the manufacture of a prototype flight vehicle. These guidelines include specifications for the mission objectives, flight paths, components, manufacturing processes, spacecraft demise and recovery, safety, and finally, cost estimates for the remainder of the glider experiment.

Keywords: Hypersonic flight, NASA, U.S. Government, Flight Testing, CubeSat, Critical Design Review

STS Paper

The Price Paid by Pacific-Indigenous Islander Nations for Science

Given the marred history of the harsh colonization of Pacific Islander Nations and the multitudes of instances in which Indigenous Pacific Islanders are forced to suffer the consequences of scientific research and development, I seek to illuminate the connections between historical colonial treatment of Pacific Islander communities and modern continuations of these trends in a Science, Technology, and Society paper (STS). The evidence I present predominantly pertains to two communities within the larger Pacific Island network: Hawaii and the Marshall Islands. With respect to Hawaii, I lay out historical subjugation of Native Hawaiians by the United States for agricultural gain, and later, strategic gains in naval power in the Pacific and how modern attitudes of Americans towards Native Hawaiians responses to the encroachment of American interests into Hawaiian land and culture perpetuate histories of imperialist attitudes. The first case study with respect to Hawaii is the construction of the Thirty-Meter-Telescope (TMT) observatory atop of a Native Hawaiian religious site at Mauna Kea. Since the start of TMT's construction in the mid 2010's, Hawaiin opposition to the telescope stems from the incredibly destructive site of construction. Furthermore, the cultural insensitivity of the U.S. Government and various universities to the public outcries and protests to the TMT's current plan of construction has reinvigorated Native Hawaiians to take a stand against both the TMT and the non-native entities who seek to maintain their control over Indigenous land. I use the STS framework, the Social Construction of Technology (SCOT), to specify how the disconnect between Native Hawaiians and world governments and universities manifests as a continuation of colonist-adjacent mentalities, as well as to provide insights into potential solutions to this conflict of interests. The second case study I present concerns the Marshall Islands and how the Bikini Atoll has been rendered uninhabitable as a result of American Nuclear Tests on the island cluster. Due to the leftover radiation from numerous nuclear tests in the mid-20th century, the Native Indigenous communities of the Bikini Atoll have been alienated from their homes and land. To this day, the many initiatives put in place by the Marshall Islands Government and the United States to reduce the interactions between potential people and radioactive topsoil in the Bikini Atoll, while resulting in remarkable improvements in the viability of the land, are still not sufficient to restore the original landscape of the island cluster. As it stands, the original Natives of the Bikini Atoll will not be allowed to return to their ancestral homelands until 2040 at the absolute earliest. I seek to employ the SCOT framework to both make aware of the causes that led to this humanitarian crisis and to best evaluate how remediation of the Bikini Atoll can be improved.

In both case studies, ignorance to Native Indigenous cultures and indifference to the effects of technological research and development on these communities have resulted in mistreatment of these ethnic minorities. I argue that, should Native representation be improved in STEM fields and institutions of higher education as a whole, more just and responsible practices with regard to scientific research will be a result.

Keywords: Hawaii, Marshall Islands, Science, Technology, and Society, Social Construction of Technology, Thirty-Meter-Telescope, Pacific Islander Communities, Colonialism, Nuclear Weapons