Thesis Project Portfolio

Mountain Directed Energy Wayfinder (D.E.W.)

(Technical Report)

An Examination of Laser-Based Guidance Systems and Relevant Applications

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The human drive towards technological innovation has brought civilization to develop some of its most impactful inventions. Yet, in a perhaps fittingly Newtonian way, every action has its own reaction: with a macroscopic lens, invention begets both scientific progress and societal consequences, shaped by users who wield these tools with potential for great good and harm. With a modern view, when taking a more critical lens to sociocultural systems that are seemingly concrete at first blush, the concept of an unequivocal truth unravels. Rather, truth is built from perspective, not dictated by a singular universal narrative, but crafted in the aggregate from individual stories.

The laser exemplifies an invention with such an impact. First introduced through Theodore Maiman's research at the Hughes Research Labs, the laser has captured the attention of both the public conscience and the scientific community for nearly seven decades. The endless speculation with its applications to human advancement is dominated first and foremost by its use as a weapon: popular science fiction is filled with depictions of laser weapons like *Star Wars'* Death Star, and as the technology continues to advance, lasers are becoming increasingly prevalent in military applications. While their use in guidance systems is most commonly recognized with regard to military use, lasers also find utility in guiding self-driving vehicles as well as in space exploration. In my thesis project, An Examination of Laser-Based Guidance Systems and Relevant Applications, I explore the use of lasers in both defense contexts and for non-military navigation systems. By considering the connections between laser devices, their inventors, and their users, I develop an overarching perspective of how these actors interact, and the consequences that arise with a technology with great potential to both help and harm.

Mountain Directed Energy Wayfinder (D.E.W.) is a project that treads this delicate balance with an educational approach. An automatic star pointer, Mountain D.E.W. is a battery-operated, cost-effective device aiming to aid amateur astronomers, simplifying stargazing for novice enthusiasts and educational groups alike. Programmed with a list of common constellations, Mountain D.E.W. provides an educational tool for identifying stars in the night sky, with a user-friendly interface and precise star tracking capabilities. Overall, Mountain D.E.W. bridges the gap between expensive telescope-assisted stargazing and manual star pointing, making astronomy more accessible and engaging for amateur stargazers, hence offering a unique, efficient, and affordable tool to aid in the exploration of celestial objects. This project covers a wide array of topics regarding laser technology, and delves into safety standards for laser products, laser hazards, pointers for safe star pointing, modernization acts, and detailed technical specifications for equipment like motors, sensors, displays, and controllers.

In simultaneously developing both projects, the connections are clear. Mountain D.E.W., as an automated laser-based star pointer, is itself a guidance system, pointing towards known coordinates to help astronomers make observations. Directly pinpointing coordinates has parallels with laser applications to both navigation systems and military use, and some clear extensions of the uses for Mountain D.E.W. could include similarities to those conventionally used in both space exploration and others. In considering the design of Mountain D.E.W., I addressed ethical design and safety concerns with respect to airspace safety, educational benefits, and light pollution, to aid the development of my thesis project.