

Thesis Project Portfolio

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

(Technical Report)

The Effect of Guidance Systems on Civilian Casualty Ratios in Modern Conflicts

(STS Research Paper)

An Undergraduate Thesis

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Targeting Stars for Education and Targeting on Munitions

Modern targeting systems are rapidly advancing through various methods such as radar, lidar, machine vision, and infrared. My technical project targets stars with a laser for educational purposes such as learning the stars with a group of cub scouts. On the other hand, the STS research focuses on the effect of targeting systems on modern munitions on civilians in combat zones particularly their effect on civilian casualties. The relation between civilian deaths and guidance systems is closely related to the technical project of the laser star pointer as the laser could be swapped for a deadly laser or other weapon and the project becomes a guidance system for a weapon.

The technical project is a laser that will point at a star chosen from a predetermined list after being calibrated to Polaris (the North Star) via user input. Calibration to Polaris allows for accurate determination of the current orientation of the gimbal relative to the night sky shifting math to relative position from Polaris. This calibration is then combined with positional and time information from a GPS module to allow for determination of the relative position of all stars in an STM32. The user will then select a star from a list of stars on the STM32. The gimbal will then move to the appropriate star and activate the laser for 10 seconds. This will allow people who do not know much about the stars to learn their names and possibly get inspired to delve more deeply into the field of astronomy. This laser pointing device is significantly cheaper than alternatives which require telescopes in the thousands of dollars. Thus, an unfilled niche in the market, providing a low-cost option for amateurs can be filled with this device.

The STS project discusses the relationship between new guidance systems and civilian casualties. Newer guidance systems, which should allow for better avoidance of civilians, did not, in fact, result in reduced civilian casualties when controlling for the size of the war. This was to be expected because there was not a change in policy that would have allowed for a reduction in civilian death. This shows that one should not expect civilian death to decrease simply because modern weapons have the ability to be more accurate. Actually, reducing civilian casualties would require a purposeful effort to do so, which is currently not there. This analysis based on combat ratios rather than absolute deaths is useful for better understanding the impact of all new weapons on the conflicts they are involved in.

The analysis of targeting technology in term of civilian death helps provide clearer answers to the morality and ethics of working on these technologies. This also includes technology that could be converted to military use such as identification technology, e.g. the laser star pointer, becoming a targeting system for weapons. If, for example, these targeting technologies ended up reducing civilian death then the ethical dilemma posed by weapons manufacturing would be lessened. The exploration in the sociotechnical project, an approach based on ratios rather than absolute numbers, would allow for this question to be answered. As of yet no targeting technology has reduced civilian casualties. This still leaves significant ethical analysis remaining but a least one dimension has been explored.