

## Sociotechnical Synthesis


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## **Sociotechnical Synthesis**

For every mechanical part that exists, there is a manufacturing process which is involved in the creation of the part. Taking care to be mindful of the waste and inefficient use of resources that could be involved in the product lifecycle is the duty of responsible mechanical engineers. When analyzed as a whole, the accumulation of even minor disregard for more sustainable methods in manufacturing results in a propagation of issues ranging from environmental harm on an ecosystem level to ethically questionable business practices. The STS research project aims to explain how laser technology, namely laser cutting, can help alleviate the environmental damage incurred by using the more widely known and traditional manufacturing methods as well as provide an argument for how improved laser technology directly promotes ethical business models. The technical project ties in with the STS research through the design and testing of a highly efficient and highly cost-effective laser cutter model that can compete with industry counterparts. The hope is that a successful technical project model serves as an example that further encourages industry developments in cheaper laser technology, which can reduce the costs of manufacturing and incentivize ethical business models while simultaneously accelerating the removal of unnecessary waste introduced everyday by traditional manufacturing methods.

To accurately frame the technical project's scope, a laser cutter market survey was undertaken of the currently available laser cutters of varying proficiencies and costs. This survey would govern the design parameters that the Capstone project laser cutter would focus on addressing. From the data acquired on the various laser cutters, some of the relevant design parameters to consider were boiled down to cost, resolution, focal length, and tube power. A \$4,000 budget was chosen upon amongst a market survey of \$500-\$7300 counterparts.

Additionally, a tube power of 100 W, resolution of 700-850 dpi, and a focal length of 50-100 mm were chosen for the best balance in cost for accuracy and power.

The STS research compares the laser cutter's abilities with those of the waterjet cutter (a manufacturing machine with a similar capacity to cut out materials in a 2D path) and the 3D printer (a rapid prototyping tool that creates volumetric shapes layer by layer). The versatility of the laser cutter is presented, specifically its ability to facilitate both subtractive and additive manufacturing functions. In this versatility, there is also a clear advantage that the laser cutter and other laser-based technology bring in terms of the reduction of waste generation. Waste generation is analyzed in terms of sheer harmful byproducts released into the environment as well as the potential for a particular technology to produce faulty and incompetent parts that need to be redone. Taking this baseline understanding of the benefits that laser cutter provides, the STS research paper further connects laser technologies in all their forms with their applications in the medical device industry. Especially as society places further strains on the healthcare system with an aging population, the need for environmentally friendly and ethical manufacturing methods for the countless number of tools and devices that are necessary to maintain people's health become increasingly more apparent. This also relates back to the Prospectus and the ethical dilemmas present in the proliferation of emerging technology such as surgical robots, where an emphasis on improvements in laser technology would go a long way in curbing malpractices associated with the costs of designing and maintaining such large surgical systems.

Through the technical project and the STS research paper, laser technologies and their future advancements will be encouraged and presented in a manner consistent with the growing

need for sustainable alternatives to the age-old manufacturing methods which contribute enormously to the current pressures on the environment and businesses.