Thesis Project Portfolio

Yakski: An Electric Waterjet Propulsion System

(Technical Report)

Selective Government Subsidization of Electric Vehicles Can Maximize Environmental Returns and Drive Consumer Acceptance of Electric Boats

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Short and Long-Term Solutions to Freshwater Habitat Destruction

Recreational boating has become increasingly common in recent decades and has exacerbated the issue of freshwater habitat destruction. My STS and technical projects focus on two distinct methods for reducing the rate of freshwater habitat destruction. My technical project produced an innovative electric freshwater propulsion system for lightweight watercraft. Through the application of water jet technology, this new system enables environmentally friendly propulsion of lightweight watercraft in shallow waters and where gas motors are prohibited. My STS research focused on how government intervention can be optimized to maximize environmental returns and the rate of acceptance of electric boats.

My technical project builds upon current electric outboard motor technology to produce an attachable electric outboard freshwater propulsion system for lightweight watercraft. This new propulsion system is designed to enable use in shallow water and where wakes and gas engines are not allowed. To achieve these goals, the propulsion system was composed of electric motors that power water jets. Water jets operate at the surface of water which enables propulsion in very shallow water while also minimizing sediment disruption. Significant effort was spent on the optimization of durability, power, and range within price constraints. The final design was successfully tested on the Rivanna Reservoir, and revealed the potential for an attachable electric propulsion system to reduce freshwater habitat destruction.

The final deliverable for the technical project may reduce aquatic habitat destruction through reduced gas motor usage in some scenarios, but current electric boats do not have the power or range for extensive application. To achieve an effective long-term solution, a sociotechnical solution is required. Through my STS research, it became clear that hybrid

electric vehicles have greater marketability and environmental returns per dollar spent. As a result, subsidization of electric vehicles should focus on hybrid electric vehicles to best drive electric vehicle demand. Increased electric vehicle demand would lead to increased electric vehicle production that would also increase technological innovation and learning. However, it became clear that economic constraints pose a greater barrier to adoption in the electric boat industry than in the electric car industry. In fact, subsidization of hybrid electric cars is more efficient than subsidization of hybrid electric boats. This realization led to the surprising conclusion that environmental returns and consumer acceptance of electric boats is best driven by hybrid electric car subsidization.

My STS and technical projects reveal the long and complex road towards limiting freshwater habitat destruction and increasing electric boat acceptance. In fact, my technical project showed the high level of difficulty in optimizing the power, range, and durability of an electric propulsion system under financial constraints. My STS research confirmed the complexity of the path towards electric boat acceptance. Electric boat acceptance can actually be best driven by government intervention through the subsidization of hybrid electric cars. These projects reveal that ethical engineering may not always manifest in the ways we expect. In fact, the future of electric boat acceptance relies upon the advancements made within hybrid electric cars.