

# Investigating Flapping Foil Propulsion

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- **Abstract:** The USNA Human Powered Submarine Team recently set a world record for top speed by a non-prop human powered sub. They used the Mirage Drive<sup>®</sup>, commercially available from Hobie Cat<sup>®</sup>. This drive utilizes flapping foil propulsion technology. At high speeds the drivers noticed a sharp decline in efficiency. The goal of this research project is to investigate the efficiency of the system and design a new “fin” to be used in future competitions.



- **Research Methods:** The force input from a human driver in a Hobie<sup>®</sup> kayak will be measured using load cells. Coupled with the speed of the peddling, “power in” can be calculated. The “power out” of the system will be calculated by relating the speed of the kayak to a previously calculated resistance curve. The efficiency of the drive system will be plotted against flapping frequency.
- **Expected Results:** A steep drop in efficiency is expected at a speed of around 10fps. It is expected that both increasing the size and stiffness of the fin will generate more thrust at higher speeds. The efficiency curve of the new fins is expected to be shifted right, to higher speeds than that of the existing Mirage Drive<sup>®</sup> system.