Propeller Shroud Design: Testing the Effectiveness of Different Cambers

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Shrouds are used with many modern day propellers, and my prior experience with underwater robotics has led me to apply this passive method to improve motor performance. This project looked at different designs with varying cambers in order to optimize output velocity. Various shrouds were mounted in a testing chamber marked with 1 inch increments. 4 milliliters of food coloring were injected with a pipette to make the flow of water visible. Using a set distance of 6 inches, a 120 frames-per-second camera was used to determine the time with the number of frames the coloring took to travel the set distance. The velocity was determined with these measurements and the average of each design was calculated from the trials' velocities. The average output velocity of the straight shroud was 56 cm/s. The mean deviation of all the data points was ≈4.3 cm/s. The average output velocity of the low camber shroud was 73 cm/s. The mean deviation of all the data points was ≈2.9 cm/s. The average output velocity of the deep camber shroud was 61 cm/s. The mean deviation of all the data points was ≈1.9 cm/s. This investigation showed that the low camber design performs more effectively than the deep camber and straight shrouds. The reason for the deep camber's lower performance could have been due to turbulence that was observed in the recordings. Further designing and testing would continue to determine the optimal camber shape.