Design and Construction of a Propeller Open Water Testing Apparatus and Testing of a Stereolithography 3D Printed Model Propeller

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This thesis describes the design and construction of a propeller open water testing apparatus for educational and experimental use at MIT. This test apparatus was built as an inexpensive alternative to conducted in-house model scale marine propeller testing. A complimentary study was conducted to explore the process of manufacturing a model propeller using additive manufacturing. A propeller open water test apparatus, commonly referred to as a test boat, is used to measure the performance of marine propellers in uniform flow. The test boats performance was validated using a Wageningen B-series aluminum propeller as a benchmark. The test boat measured the open water performance of this benchmark within a small percentage of error. The practicality of using additive manufacturing to produce a model propeller was explored by manufacturing and testing a 3D printed replica of the benchmark propeller. The replica propeller was manufactured using a benchtop stereolithography 3D printer. The open water characteristics of the replica were measured and compared to the benchmark propeller. Results of this testing revealed some limitation of 3D printed model propellers, such as inadequate blade strength and imprecision of leading and trailing edge geometry. This research has provided MIT students with an inexpensive method to conduct preliminary marine propeller testing and offers in-sight into the use of additively manufactured model propellers.

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