Abstract Submitted
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On the efficient swimming of a ray-inspired underwater vehicle Part I: Experimental study on swimming optimization of control and fin structure[1] JIANZHONG ZHU, MERVYN LOPEZ, VENTRESS WILLIAMS, University of Virginia, THEOPHILUS ALUKO, University of Maryland Baltimore County, HAIBO DONG, HILARY BART-SMITH, University of Virginia — Batoid fish such as manta and cownose rays are among the most agile and energy efficient swimming creatures. These capabilities arise from flapping and bending their dorsally flattened pectoral fins. To assess this contribution, this study focuses on the study of a bio-inspired underwater vehicle—the MantaBot—where biological design criteria are applied. The MantaBot consists of two parts: a rigid body rendered from a CT scanning image of a cownose ray and two flexible fins driven by tensegrity actuators. The experiments were conducted in a water tank where the MantaBot was attached to a rail for rectilinear swimming. Three stereo-videos were taken and digitized to measure the 3D kinematics. Results showed that the fins conduct deformations in both spanwise and chordwise directions during steady swimming. Optimal operation conditions were determined for fastest swimming by surveying a wide range of parameters. Contributions of thrust generation and amplitude hindrance of various portions of the fin volume were examined. Additionally, fin tip structure, material and bending properties were studied for optimal swimming.

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