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Propulsive Forces of a Biomimetic Undulating Fin KENNETH KALUMUCK, Johns Hopkins University Applied Physics Laboratory, ALAN BRANDT, MEHRAN ARMAND — Understanding gained from much recent work on force production mechanisms of aquatic organisms holds great promise for improved undersea vehicle propulsion and maneuvering. One class of fish locomotion is that of the median fin utilized by animals such as squid, cuttlefish, knifefish, and seahorse. It is characterized by undulatory motion that creates traveling waves along the fin. Results of experiments conducted on a submerged mechanical underwater undulating fin test bed are presented. The 0.5 m long fin is mounted to a cylindrical body and consists of a flexible skin attached to ribs driven by an adjustable cam mechanism and variable speed motor that enables changing the characteristics of the undulating wave(s). Forces produced were measured in a captive mode under quiescent conditions as well in the presence of an ambient current. Propulsive forces are characterized as a function of the fin width, oscillation frequency, amplitude, and wavelength. Free swimming experiments were also conducted to determine the point of self propulsion. Flow field structure visualization using dye tracers is presented for selected cases. Estimates of performance and applications for use with larger scale vehicles are discussed.

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