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Flow Structures Generated by a Robotic Sea Lion Foreflipper ADITYA A. KULKARNI, ELI KASHI, GINO PERROTTA, MEGAN C. LEFTWICH, The George Washington University — Unlike most biological swimmers that rely on body/caudal fin (BCF) type of locomotion, a California sea lion produces thrust by moving its large foreflippers from above its head into a position abducted against its abdomen, a motion called a clap. This is followed by a long glide in a streamlined position. The flow structures resulting from this motion will not resemble the traditionally seen structures during BCF swimming, namely the reverse von Krmn street. Here, we use particle image velocimetry (PIV) to study the flow around an anatomically correct silicone flipper that is actuated by a servo motor. The flipper is mounted on a robotic platform and is programmed to go through the motions of a sea lion clap. The resulting data indicates that thrust is not produced through compression of fluid between the ventral side of the flipper and the body. Instead, the surrounding fluid is entrained by the upper surface of the flipper, producing vortices that run along the span and directly off the tip of the flipper. We also notice a cutoff frequency after which the efficiency of velocity production diminishes, which indicates the existence of an ideal ratio between rotational velocity and tip speed.

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