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Hydrodynamics of a Digitized Adult Humpback Whale Flipper WESLEY N. FASSMANN, SAMUEL J. MCDONALD, SCOTT L. THOMSON, Brigham Young University, FRANK E. FISH, West Chester University — During feeding, humpback whales turn with a turn radius of up to $1/6^{th}$ of their length towards schools of fish enclosed by bubble nets. This high maneuverability requirement is facilitated by high aspect ratio flippers with leading edge tubercles that delay stall. Previous experimental and computational studies have used idealized models, such as airfoils with scalloped leading edges, to explore the influence of leading edge tubercles on boundary layer separation, vortex generation, and airfoil lift and drag characteristics. Owing to the substantial size of the flipper, no studies have been performed on a digitized adult humpback flipper with real geometry. In this study the hydrodynamics of a realistic humpback flipper model were explored. The model was developed by digitizing a sequence of 18 images circumscribing the suspended flipper of a beached humpback whale. A physical prototype was constructed based on the resulting 3D model, along with a complementary model with the tubercles removed. Experimentally-obtained measurements of lift and drag were used to study the influence of the tubercles. In the presentation, digitization and flow measurement methods are described, and the flow data and results are presented and discussed.

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