Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

A Novel Cylindrical Clap-and-Fling Maneuver by Swimming Marine Snails FERHAT KARAKAS, ALI AL DASOUQI, University of South Florida, AMY MAAS, The Bermuda Institute of Ocean Sciences, DAVID MURPHY, University of South Florida — Many insects use the Weis-Fogh clap-and-fling maneuver once per wingbeat to generate lift. Lighthill (1973) hypothesized that using this mechanism twice per stroke would create two circular vortex rings, thereby maximizing downward momentum per unit kinetic energy. We show via high speed stereophotogrammetry and micro-PIV that several pteropod species, both shelled and shell-less, do indeed use a variation of this maneuver twice per wingbeat. These pteropods flap their highly flexible wings 180^oin both posterior and anterior directions so that their wingtips overlap at the end of both half-strokes to create a cylinder. The animal forces water downwards in a jet as this cylinder forms (the 'clap'). As the wings then begin the next half-stroke, the cylinder transforms into a cone with the narrow end along the wings' trailing edges. This cylindrical clap-and-fling maneuver induces downward flow into the cone and forms a lift-enhancing vortex ring around the wings' leading edges (the 'fling'). We discuss implications of performing the clap-and-fling maneuver with this cylindrical geometry versus the classic version used by insects. Further, we present preliminary results from a soft robot pteropod wing being developed to study the fluid dynamics of cylindrical clap and fling.

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Date submitted: 02 Aug 2019 Electronic form version 1.4