Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Inline Motion in Flapping Foils for Improved Force Vectoring Performance JACOB IZRAELEVITZ, Massachusetts Institute of Technology, GABRIEL WEYMOUTH, Singapore-MIT Alliance for Research and Technology, MICHAEL TRIANTAFYLLOU, Massachusetts Institute of Technology — Flapping foils are a promising alternative actuation technique for aerial and underwater vehicles because they can drastically improve maneuverability by vectoring the actuator force. However, the standard implementation of a flapping foil motion, where the foil is oscillated exactly perpendicular to the free stream flow, does not fully develop this force vectoring capability. Many biological examples of flapping foil actuators include an additional degree of freedom, where the foil is allowed to translate parallel to the flow. This degree of freedom can either powerfully augment the mean lift, or mitigate oscillating lift forces for improved thrust efficiency. We develop a parameterization of this inline motion and outline various motion schemes to improve the force vectoring performance of a flapping foil actuator. We then investigate these motion schemes with both CFD solutions and towing tank experiments, thereby expanding the force vectoring options available for the flapping foil actuator.

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Date submitted: 03 Aug 2012 Electronic form version 1.4