Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Scaling the hydrodynamic performance of heaving flexible panels[1]

DANIEL QUINN, Princeton University, GEORGE LAUDER, Harvard University, ALEXANDER SMITS, Princeton University and Monash University — We present an experimental investigation of flexible panels actuated with heave oscillations at their leading edge. Our methods consist of kinematic video analysis, particle image velocimetry (PIV), and direct force measurements. Both the trailing edge amplitude and the mode shapes of the panel are found to scale with dimensionless ratios originating from the Euler-Bernoulli beam equation. Time-averaged thrust increases with heaving frequency, but also shows localized boosts around resonant frequencies where the trailing edge amplitude is maximized. For a constant heave amplitude, the time-averaged thrust coefficient is shown to be a function of Strouhal number over a wide range of conditions. Instantaneous thrust shows two peaks per oscillation cycle, occurring during the mid up- and down-stroke of the leading edge.

[1]Supported by the Office of Naval Research under Program Director Dr. Bob Brizzolara, MURI grant number N00014-08-1-0642, as well as by the National Science Foundation, Grant DBI 1062052

Daniel Quinn
Princeton University

Date submitted: 25 Jul 2013 Electronic form version 1.4