Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Global Vorticity Shedding on Rectangular and Streamlined Foil Geometries[1] STEPHANIE STEELE, Massachusetts Institute of Technology, JASON DAHL, University of Rhode Island, GABRIEL WEYMOUTH, Singapore MIT Alliance for Research and Technology, MICHAEL TRIANTAFYLLOU, Massachusetts Institute of Technology — We explore several aspects of the fluid phenomenon we call global vorticity shedding. Global vorticity shedding occurs when an object in a fluid with circulation suddenly vanishes, shedding the entirety of the boundary layer vorticity into the wake at once. Global vorticity shedding is in distinct contrast with traditional massive separation shedding, in which vorticity is shed from a body from only a few separation points into the fluid. In our experiments, we approximate the disappearance of a towed foil by rapidly retracting the foil in the span-wise direction. We show that for a square-tipped vanishing foil at an angle of attack, the globally shed boundary layer vorticity forms into primary vortices, which evolve and eventually amalgamate with secondary vortices to leave two lasting vortices in the wake. The secondary vortices are a result of three-dimensionality in the flow. We further explore streamlined foil geometries to achieve a simpler and less three-dimensional wake. Vortex formation times are small, with vortices fully formed nearly instantaneously in the flow, making the application of global vorticity shedding promising for a force transducer to impart large and fast maneuvering forces on an underwater vehicle.

[1]This research was made with Government support under and awarded by DoD, Air Force Office of Scientific Research, National Defense Science and Engineering Graduate (NDSEG) Fellowship, 32 CFR 168a.

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Date submitted: 03 Aug 2012 Electronic form version 1.4