Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Hydrodynamics and bio-locomotion of fast start mechanism in krill: Caridoid escape response A. CONNOR, D. ADHIKARI, D. RANJAN, D.R. WEBSTER, Georgia Tech — Krill are shrimp-like crustaceans with a high degree of mobility and a variety of documented swimming behaviors. The caridoid escape response, a fast-start mechanism unique to crustaceans, occurs when the crustacean performs a series of rapid abdominal flexions and tail flipping that result in powerful backward strokes. For the first time, the propulsion behavior and flow disturbance of a caridoid response performed by an Antarctic krill (*Euphausia superba*) has been quantified using a tomographic Particle Image Velocimetry (tomo-PIV) system. This system was used to quantify the three-dimensional flow field around and in the wake of a free-swimming *E. superba* as it performs the maneuver. From kinematic analysis, it was determined that the animal performs an abdominal flexion and tail flip combination that leads to an acceleration over a 50 ms interval allowing it to reach a maximum speed of 57 cm/s. Counter-rotating vortices are shed in the wake of the krill located off of the tip of the antennae. Antarctic krill typically swim in a low-to-intermediate Reynolds number (Re) regime where viscous forces are significant, but as shown by this analysis, its high maneuverability allows it to quickly change its body angle and swimming speed. The velocity and vorticity field data shed light on both the flow behavior in the intermediate Re regime and the intricacies of bio-locomotion of zooplankton.

D.R. Webster
Georgia Tech

Date submitted: 31 Jul 2020 Electronic form version 1.4