Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Quasi-steady modeling of rolling and pitching foils[1] PROMODE R. BANDYOPADHYAY, DAVID N. BEAL, Naval Undersea Warfare Center, Newport, RI — Unsteady foils are accurately modeled as the dynamic rendition of the steady state foil lift-drag (thrust) characteristics while retaining its basic pre-stall characteristic. The foil normal force, of which lift and drag are resolved representations, is a cross-stream force which produces leading and trailing edge separated drag vortices at high angles of attack. Primarily rolling and also pitching if present are dynamic strategies for retaining the two drag vortices over the foil. In the process, the foil angle of attack and normal force oscillate and stall is prevented. Steady state, as well as unsteady measurements of forces, power, surface flow critical points and visualization of dynamic stall vortices have been carried out for foils of two different spans. Good agreement between the quasi-steady model and unsteady force and power measurements have been achieved in both instantaneous time signatures and in cycle averaged values at all angles of attack.

[1]Sponsored by the Cognitive and Neurosciences Division of ONR.

Promode Bandyopadhyay
Naval Undersea Warfare Center, Newport, RI

Date submitted: 13 Jul 2006 Electronic form version 1.4