Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Dynamic Behaviour of Ventilated Hydrofoils. MORTEN KJELDSEN, Flow Design Bureau, ROGER ARNDT, MARTIN WOSNIK, University of Minnesota — In certain types of pumping applications oscillations are induced by operation with liquids containing a free gas load. In order to understand the physics of this process, a series of tests with a ventilated A 2D NACA 0015 hydrofoil were performed in the water tunnel at the St. Anthony Falls Laboratory of the University of Minnesota. The special bubble removal feature of the water tunnel allowed continuous ventilation without experiencing visible bubbles upstream the hydrofoil. These studies build on previous work on cavitation-induced oscillations. Gas injection studies were made over a range of gas flow rates and test section pressure. The results clearly show that lift oscillations increase in intensity when the gas load is increased. The point of maximum unsteadiness is also associated the rapid decline of the foil performance as measured as average lift. Further increase of the gas injection load gives a steady behaviour with almost no lift. These experiments are compared with traditional cavitation experiments. The similarities between gas injection- and cavitation induced unsteadiness on the hydrofoil are many, but the amplitude of lift oscillations found on the foil with gas injection corresponds to about 50% of that found for cavitating hydrofoils. The fact that the oscillations are periodic leads to the consideration of both passive and active control.

Roger Arndt
University of Minnesota

Date submitted: 02 Aug 2006 Electronic form version 1.4