Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Travelling waves and fold localization in hovercraft seals[1] ANDREW WIGGINS, STEVE ZALEK, MARC PERLIN, STEVE CECCIO, University of Michigan — The seal system on hovercraft consists of a series of open-ended fabric cylinders that contact the free surface and, when inflated, form a compliant pressure barrier. Due to a shortening constraint imposed by neighboring seals, bow seals operate in a post-buckled state. We present results from large-scale experiments on these structures. These experiment show the hydroelastic response of seals to be characterized by striking stable and unstable post-buckling behavior. Using detailed 3-d measurements of the deformed seal shape, dominant response regimes are identified. These indicate that mode number decreases with wetted length, and that the form of the buckling packet becomes localized with increased velocity and decreased bending stiffness. Eventually, at a critical pressure, travelling waves emerge. To interpret the wide range of observed behavior, a 2-d nonlinear post-buckling model is developed and compared with the experimental studies. The model shows the importance of seal shortening and the buckling length, which is driven by the balance of hydrodynamic and bending energies. Preliminary scaling laws for the fold amplitude and mode number are presented. The experiments may ultimately provide insight into the bedeviling problem of seal wear.

[1]Sponsored by the Office of Naval Research under grant N00014-10-1-0302, Ms. Kelly B. Cooper, program manager

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Date submitted: 01 Aug 2013 Electronic form version 1.4