Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Measurements of planing forces and cavity shapes on cylindrical afterbodies AREN HELLUM, JESSE BELDEN, DAVID BEAL, STEPHEN HUYER, CHARLES HENOCH, DANA HRUBES, NUWC-Newport — Supercavitation is a drag reduction technique by which an underwater body is enclosed over a significant portion of its length in a bubble of gas. Hydrodynamic forces act on the body only through contact with the nose and a planing section at the rear. Models of the planing forces typically assume that the body is placed into a cavity which is unchanged by the presence of the body, and the present study was designed to test the validity of this assumption. Measurements were taken of the planing forces for five afterbody lengths over a range of angles concurrently with photographs showing the size and shape of the cavity produced. These observations reveal that the cavity form and growth rate are significantly affected by both the length and angle of attack of the body; the length of the cavity shrinks at the same angle of attack as the body length is reduced past a critical threshold, suggesting a hydrodynamic interaction between the afterbody trailing edge and the cavity. Additionally, the planing forces demonstrate a non-monotonic dependence on attack angle that is not readily explained by existing models, specifically a lift crisis for short bodies in which the planing lift goes to zero over a range from -1 to -3 degrees.

Aren Hellum
NUWC-Newport

Date submitted: 30 Jul 2015 Electronic form version 1.4