Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Viscous Added Mass of a Moving Solid Object in a Closed Liquid-Filled Container J.R. TORCZYNSKI, L.A. ROMERO, Sandia National Laboratories — A moving solid object in a closed liquid-filled container is shown to have a viscous added mass in the quasi-steady Stokes limit. The viscous added mass is similar to the added mass for potential flow. The added-mass force is the product of the viscous added mass and the object's acceleration and is analogous to but distinct from the drag force, which is the product of the drag coefficient and the object's velocity. Both the drag coefficient and the viscous added mass can be computed directly from the quasi-steady Stokes solution for the liquid velocity field. The viscous added mass arises from the fact that the object's acceleration changes the kinetic energy of the liquid as well as the object. If the object fills most of the container's cross section, the viscous added mass is much larger than the object's mass and thus is dynamically significant. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

John Torczynski
Sandia National Laboratories

Date submitted: 20 Jun 2012 Electronic form version 1.4