Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Potential Flow Model for Compressible Stratified Rayleigh-Taylor Instability[1] GRANT RYDQUIST, SCOTT RECKINGER, MARK OWKES, Montana State Univ, SCOTT WIELAND, University of Colorado, Boulder — The Rayleigh-Taylor Instability (RTI) is an instability that occurs when a heavy fluid lies on top of a lighter fluid in a gravitational field, or a gravity-like acceleration. It occurs in many fluid flows of a highly compressive nature. In this study potential flow analysis (PFA) is used to model the early stages of RTI growth for compressible fluids. In the localized region near the bubble tip, the effects of vorticity are negligible, so PFA is applicable, as opposed to later stages where the induced velocity due to vortices generated from the growth of the instability dominate the flow. The incompressible PFA is extended for compressibility effects by applying the growth rate and the associated perturbation spatial decay from compressible linear stability theory. The PFA model predicts theoretical values for a bubble terminal velocity for single-mode compressible RTI, dependent upon the Atwood (A) and Mach (M) numbers, which is a parameter that measures both the strength of the stratification and intrinsic compressibility. The theoretical bubble terminal velocities are compared against numerical simulations. The PFA model correctly predicts the M dependence at high A, but the model must be further extended to include additional physics to capture the behavior at low A.

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Date submitted: 27 Sep 2017 Electronic form version 1.4