Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Drag reduction due to interstitial air in a granular medium TESS HOMAN, DEVARAJ VAN DER MEER, Physics of Fluids, University of Twente — The force experienced by an object while it penetrates a pre-fluidized sand bed strongly depends on the ambient air pressure. In this work we experimentally investigate the influence of interstitial air by systematically varying the penetration velocity and the ambient air pressure and measuring the resulting force required to push the intruder into the sand bed. Counterintuitively, we find that for the intruder to move faster through the bed a *lower* force is required. We hypothesize that, while the object moves down, sand in front of the intruder is compacted and the air in this compactified region is trapped. At higher penetration velocities air has no time to move out of the way causing a pressure build-up in front of the ball which leads to drag reduction. To test this hypothesis, we perform experiments at reduced ambient air pressures and find that indeed the dependence on the intruder velocity disappears: The measured force is constant and equal to the value of the drag found in the quasi-static limit, which emphasizes the role of air.

Tess Homan
Physics of Fluids, University of Twente

Date submitted: 01 Aug 2013 Electronic form version 1.4