Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Design of a Localized Fluidization Burrowing Robot DANIEL DORSCH, AMOS WINTER, MIT — This presentation will focus on the critical fluid and granular mechanics principles that drove the design of RoboClam 2.0, a self-actuated, radially expanding underwater burrowing device. RoboClam 2.0 was inspired by the Atlantic razor clam, Ensis directus, which burrows by contracting its valves and fluidizing the surrounding soil to reduce burrowing drag. This contraction results in a localized fluidized region occurring 1—5 body radii away from the animal. Moving through a fluidized, rather than static, soil requires energy that scales linearly with depth, rather than depth squared. In addition to providing an advantage for the animal, localized fluidization may yield significant value to engineering applications such as subsea robot anchoring and pipe installation. RoboClam 2.0 is sized to be an anchoring platform for autonomous underwater vehicles. We will present the scaling relationships that can be used to design RoboClam derivatives for different size scales and applications. The critical speed, displacement and force with which the device must contract to create fluidization are calculated based on soil parameters. These parametric relationships allow for choosing actuators of appropriate size and power output for desired burrowing performance.

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Date submitted: 01 Aug 2014 Electronic form version 1.4