Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Managing oils pumplessly on open surfaces[1] ARITRA GHOSH, JARED MORRISSETTE, University of Illinois at Chicago, JOSEPH MATES, Air Force Research Laboratory, CONSTANTINE MEGARIDIS, University of Illinois at Chicago — Passive management of low-surface-tension liquids (e.g. oils) can be achieved by tuning curvature of liquid volumes (Laplace pressure) on juxtaposed oleophobic/oleophilic domains. Recent advancements in material chemistry in repelling low-surface-tension liquids has enabled researchers to fabricate surfaces and transport oils without the aid of gravity or using a pump. Liquid transport on such surfaces harnesses the force arising from the spatial contrast of surface energy on the substrate, providing rapid fluid actuation. In this work, we demonstrate and study the liquid transport dynamics (velocity, acceleration) in open air for several oils of interest (Jet A, hexadecane, mineral oil) with varying surface tension and viscosity. High-speed image analysis of the motion of the bulk liquid is performed using a droplet-shape tracking algorithm; dominant forces are identified and model predictions are compared with experimental data. Experimental and analytical tools offer new insight on a problem that is relevant to open-surface passive oil transport devices like propellant management devices, oil tankers and many more.

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Date submitted: 03 Aug 2017 Electronic form version 1.4