Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Air entrainment mechanisms of a forced plunging jet[1] SOPHIA RELPH, KEN KIGER, University of Maryland, AKASH DHRUV, ELIAS BALARAS, George Washington University — Plunging jets play a major role in the quality of cast metal parts, as the pouring process can entrain metal oxides in much the same way as pouring water captures bubbles. These air and oxide pockets interfere with the metals crystal structure and can compromise strength and fatigue life. The mitigation of such defects is of great interest to foundries. Most research on plunging jets relevant to metal casting considers either smooth or passively disturbed jets that result from a turbulent nozzle state, with little characterization beyond the variance of the velocity. We know that at higher velocities, jet disturbances play a large role in air entrainment, but the literature is inconclusive on the mechanism by which this occurs. The current work examines the role of carefully controlled forced disturbances on both a plunging jet and the pool surface, allowing us to correlate surface disturbance properties with air entrainment behavior. The current effort is focused on determining the size (wavelength and amplitude) of the disturbances, as well as the relative phasing, on controlling the inception of air entrainment and the volume of the resulting air entrainment events. Results from a laboratory-scale air/water experiment and corresponding DNS will be presented.

[1]Work sponsored by the DLA Troop Support Philidelphia, PA and the Defense Logistics Agency Fort Belvoir, VA under contract SP4701-18-D-1200

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Date submitted: 31 Jul 2019 Electronic form version 1.4