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The Thermal Structure of a Near Surface Developing Turbulent Jet on Clean and Contaminated Free-surfaces K. PETER JUDD, NRC Fellow, GEOFFREY B. SMITH, ROBERT A. HANDLER, Naval Research Laboratory — The thermal structure of a near surface turbulent submerged round liquid jet on clean and contaminated free-surfaces was investigated experimentally for several Reynolds numbers and depth to nozzle diameter ratios (h/d). The objective of this investigation is to shed light on the interaction and morphology of near surface turbulent structures by examining their resulting thermal signatures. A gravity feed supplied the jet water, whose ambient temperature is slightly above that of the test facility. Thus the warmer fluid serves as a passive marker. Using high spatial and temporal resolution infrared imagery, thermal maps of the surface were generated. The detector, an IR CCD camera, was sensitive to radiation in the 3-5 micron wavelength band with temperature sensitivity of 0.02 K. As the Reynolds number was increased from 1000 to 4800, clear structural changes in the thermal field were apparent at the turbulent/non-turbulent interface and in the core region. In addition, the subsurface flow was simultaneously interrogated using DPIV. Surface thermal structures are discussed in light of the resulting hydrodynamic characteristics of the flow field and level of surface contamination.

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