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Heated Jets Emitting From a Rectangular Stack into a Cross Wind B.E. JOHNSON, G. ELLIOTT, K.T. CHRISTENSEN, University of Illinois — A detailed analysis of jets in cross-flow is performed where jets heated to a centerline temperature $T_\circ = 425\,\mathrm{K}$ emit from a rectangular stack ($AR = 3.76$) into $T_\infty = 300\,\mathrm{K}$ cross-wind at area-averaged momentum flux ratio $r = 3.3$. Cross-flow and jet centerline velocities are $U_\infty = 10\,\mathrm{m/s}$ and $V_\circ = 50\,\mathrm{m/s}$, respectively. Injection is normal to the bounding wall from a raised stack such that the initial incidence of jet interaction with cross-flow occurs well outside of the boundary layer. Rake-mounted thermocouple measurements of mean temperature and cross-plane stereoscopic PIV measurements of the turbulent flow field are performed at multiple stations downstream of the stack in spanwise–wall- normal regions of interest. Stack yaw angles of 0°, 45°, and 90° comprise a set of key orientations from which inferences can be made of real-world heated jet in cross-flow behavior where cross-flow directionality may vary under shifting mean wind direction. From the measurements made under each of these stack orientations, the downstream dispersion of the heated jet fluid is characterized as is the downstream evolution of the turbulence and associated vortical structures.

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