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Effect of periodic wakes on jets injected into turbulent boundary layers RALPH VOLINO, U.S. Naval Academy — Surfaces subject to high temperature flow are often cooled using lower temperature jets injected through the surface. The jets typically have low velocity and are inclined at shallow angles so that they remain near the surface, forming a protective film. The technique is known as "film cooling." The process can be complicated by periodic turbulent wakes shed from objects moving upstream of the cooled surface. In the present study, jets with various velocities were injected into turbulent boundary layers on a flat-plate test wall. Periodic wakes were generated with a spoked wheel, located upstream in the wind tunnel. The jet behavior was determined through instantaneous flow temperature measurements made with a traversing cold-wire (constant current) probe. The measurements were ensemble averaged to show the temperature field at various phases during the wake passing cycle. The wakes tend to force the jets closer to the surface, enhancing their cooling effectiveness, but the associated turbulence has the opposite effect and accelerates coolant dispersal. The net effect depends on the jet velocity. Results, including animations of the experimentally measured flow temperature fields, will be presented.

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