

Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Simulations of High Speed Turbulent Jets in Crossflow¹ XI-
AOCHUAN CHAI, KRISHNAN MAHESH, University of Minnesota — Numerical
simulations are used to study an under-expanded sonic jet injected into a supersonic
crossflow and an over-expanded supersonic jet injected into a subsonic crossflow,
where the flow conditions are based on Santiago *et al.*'s (1997) and Beresh *et al.*'s
(2005) experiments, respectively. A finite volume compressible Navier–Stokes solver
developed by Park & Mahesh (2007) for unstructured grids is used. The simula-
tions successfully reproduce experimentally observed shock systems and flow vorti-
cal structures such as the barrel shock, Mach disk, horseshoe vortices that wrap up
in front of the jet and the counter rotating vortex pair (CVP) downstream of the
jet. The dynamics of these flow structures are discussed, as well as the influence of
grid resolution and the effect of inflow turbulence. The time averaged flow fields are
compared to the experimental results, and reasonable agreement is observed.

¹This work is supported by the National Science Foundation under grand CTS-
0828162.

Xiaochuan Chai
University of Minnesota

Date submitted: 06 Aug 2010

Electronic form version 1.4