Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Exploration and Control of Transverse Jet Shear Layer Instabilities[1] JULIETT DAVITIAN, ROBERT M'CLOSKEY, ANN KARAGOZIAN, UCLA — This experimental study explores transverse jet shear layer instabilities and the mechanisms by which these instabilities can be used to strategically control jet behavior via forcing. Jets injected from either flush or elevated nozzles demonstrate a strengthening of the instabilities with increasing crossflow magnitude, with initial modes occurring closer to the jet exit as the jet-to-crossflow velocity ratio R is reduced, and with evidence of unusual mode shifting as one moves along the upstream shear layer. These instabilities appear convective in nature when $R > 3.5$, and the shear layer in this regime is affected by even low level sinusoidal jet forcing. The flush-injected transverse jet undergoes a significant transition in the shear layer instability as R is reduced below 3.5, with the development of strong, distinct fundamental and harmonic modes that are not influenced by low level sinusoidal forcing. In contrast, the elevated jet's instabilities are weakened in the range $4 > R > 1.25$, largely as a result of coflow exterior to the jet nozzle, but once the transverse jet has deflected significantly, for $R < 1.25$, the instabilities for the elevated jet resemble those for the flush-injected transverse jet. At these low R conditions, much higher amplitude forcing is required to produce a jet response, necessitating the introduction of a characteristic time scale associated with vorticity generation via square wave excitation.

[1]Supported by NSF grant CTS-0457413 and the NASA GSRP.

Ann Karagozian
UCLA

Date submitted: 04 Aug 2006 Electronic form version 1.4