Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Effects of collar cross-sectional shape on self-excited collared jets

K.S. TAN, T.H. NEW, H.M. TSAI, Temasek Laboratories — Hot-wire measurement studies are performed to understand the velocity fields and turbulence statistics arising from self-excited collared jets. The effects of azimuthal variations in the collar step height are studied by using collars of different cross-sectional shapes and lengths. Results show that as the collar length increases, general centerline velocity decay rates decrease initially but rise rapidly to a maximum. At their respective optimum collar lengths, the square collar is found to incur a higher velocity decay rate with a significantly longer collar, as compared to the circular collar. Furthermore, the presence of a collar leads to turbulence suppression and the inhibition of vortex pairing in the near field downstream of the collar, with a circular collar effecting higher turbulence suppression. The presence of a collar is also found to accelerate transition to fully developed turbulence. A circular collar leads to an abrupt increase in self-excitation amplitude due to its constant step height whereas a square collar promotes a more gradual rise in excitation with a lower amplitude maximum. Spectra analysis indicates that, as compared to the circular collar, the square collar results in a smaller variation of the dominant frequencies within each excitation stage which also extends over a longer range of collar length values. The effects of a triangular collar will also be examined.

K. S. Tan
Temasek Laboratories

Date submitted: 10 Aug 2005 Electronic form version 1.4