Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Acoustic far-field of shroud-lip-scattered instability modes of supersonic co-flowing jets ARNAB SAMANTA, Indian Institute of Science, JONATHAN B. FREUND, University of Illinois at Urbana-Champaign — We consider the acoustic radiation of instability modes in dual-stream jets, with the inner nozzle buried within the outer shroud, particularly the upstream scattering into acoustic modes that occurs at the shroud lip. For supersonic core jets, several families of instability waves are possible, beyond the regular Kelvin-Helmholtz (K-H) mode, with very different modal shapes and propagation characteristics, which are candidates for changing the sound character of very high-speed jets. The co-axial shear layers are modeled as vortex sheets, with the Wiener-Hopf method used to compute these modes coupled with an asymptotic solution for the far-field radiation. A broadband mode spectra as well as single propagating modes are considered as incident and scattered waves. The resulting far-field directivity patterns are quantified, to show the efficiency of some of these radiation mechanisms, particularly in the upstream direction, which is not directly affected by the Mach-wave-like sound that is radiated from these modes irrespective of any scattering surface. A full Kutta condition, which provides the usual boundary condition at the shroud lip, is altered to examine how vortex shedding, perhaps controllable at the lip, affects the radiated sound.

Arnab Samanta
Indian Institute of Science

Date submitted: 02 Aug 2013 Electronic form version 1.4