Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Identification of the resonant modes in supersonic impinging jets using fast response pressure sensitive paint TIMOTHY DAVIS, ADAM EDSTRAND, FARRUKH ALVI, LOUIS CATTAFESTA, Florida State University, DAISUKE YORITA, KEISUKE ASAI, Tohoku University — High speed impinging jets have been the focus of several studies owing to their practical application and resonance dominated flow-field. The current study utilizes fast-response pressure sensitive paint (PSP) to examine the jet instability modes of a Mach 1.5 normally impinging jet. These modes are associated with high amplitude, discrete peaks in the power spectra and can be identified as having either axisymmetric or azimuthal modes. Phase-averaged images are acquired at various nozzle to plate spacings and at frequencies of several kHz. Using an unsteady pressure transducer on the impingement surface as a reference signal, a high speed LED with a wavelength of 460 nm is used to illuminate the PSP. The paint fluorescence is then recorded with a CCD camera. The average pressure distribution is removed from the acquired images, resulting in the phase-averaged unsteady pressure distribution. The processed images reveal axisymmetric modes for all nozzle to plate spacings tested except at 4 jet diameters. At this spacing, three distinct resonant modes are identified.

Timothy Davis
Florida State University

Date submitted: 01 Aug 2013 Electronic form version 1.4