Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Pressure-Velocity Correlations in the Cove of a Leading Edge Slat

STEPHEN WILKINS, PATRICK RICHARD, JOSEPH HALL, University of New Brunswick — One of the major sources of aircraft airframe noise is related to the deployment of high-lift devices, such as leading-edge slats, particularly when the aircraft is preparing to land. As the engines are throttled back, the noise produced by the airframe itself is of great concern, as the aircraft is low enough for the noise to impact civilian populations. In order to reduce the aeroacoustic noise sources associated with these high lift devices for the next generation of aircraft an experimental investigation of the correlation between multi-point surface-mounted fluctuating pressures measured via flush-mounted microphones and the simultaneously measured two-component velocity field measured via Particle Image Velocimetry (PIV) is studied. The development of the resulting shear-layer within the slat cove is studied for Re=80,000, based on the wing chord. For low Mach number flows in air, the major acoustic source is a dipole acoustic source tied to fluctuating surface pressures on solid boundaries, such as the underside of the slat itself. Regions of high correlations between the pressure and velocity field near the surface will likely indicate a strong acoustic dipole source. In order to study the underlying physical mechanisms and understand their role in the development of aeroacoustic noise, Proper Orthogonal Decomposition (POD) by the method of snapshots is employed on the velocity field. The correlation between low-order reconstructions and the surface-pressure measurements are also studied.

Stephen Wilkins
University of New Brunswick

Date submitted: 31 Jul 2015 Electronic form version 1.4