AMELIA CESTOL Test: Acoustic Characteristics of Circulation Control Wing with Leading- and Trailing-Edge Slot Blowing

William C. Horne*, Nathan J. Burnside**
NASA Ames Research Center

Abstract submitted for presentation at AIAA 51st Aerosciences Meeting

The AMELIA[1] Cruise-Efficient Short Take-off and Landing (CESTOL) configuration concept was developed to meet future requirements of reduced field length, noise, and fuel burn by researchers at Cal Poly, San Luis Obispo [1,2] and Georgia Tech Research Institute [3,4] under sponsorship by the NASA Fundamental Aeronautics Program (FAP), Subsonic Fixed Wing Project [5]. The novel configuration includes leading- and trailing-edge circulation control wing (CCW), over-wing podded turbine propulsion simulation (TPS). Extensive aerodynamic measurements of forces, surfaces pressures, and wing surface skin friction measurements were recently measured over a wide range of test conditions in the Arnold Engineering Development Center(AEDC) National Full-Scale Aerodynamics Complex (NFAC) 40- by 80-Ft Wind Tunnel. Acoustic measurements of the model were also acquired for each configuration with 7 fixed microphones on a line under the left wing, and with a 48-element, 40-inch diameter phased microphone array under the right wing.

This presentation will discuss acoustic characteristics of the CCW system for a variety of tunnel speeds (0 to 120 kts), model configurations (leading edge(LE) and/or trailing-edge(TE) slot blowing, and orientations (incidence and yaw) based on acoustic measurements acquired concurrently with the aerodynamic measurements. The flow coefficient, $C\mu = mV_{SLOT}/qS_W$ varied from 0 to 0.88 at 40 kts, and from 0 to 0.15 at 120 kts. Here m is the slot mass flow rate, V_{SLOT} is the slot exit velocity, q is dynamic pressure, and S_W is wing surface area. Directivities at selected 1/3 octave bands will be compared with comparable measurements of a 2-D wing at GTRI, as will as microphone array near-field measurements of the right wing at maximum flow rate. The presentation will include discussion of acoustic sensor calibrations as well as characterization of the wind tunnel background noise environment.