

## Experimental Aeroacoustic Investigations of a Swept Flap Side Edge

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High lift devices (HLDs) deployed during flight takeoff and landing are a notable contributor to airframe noise. Prior studies have focused on simplified two-dimensional HLDs to build foundational understanding, with fewer investigations into the three dimensional effects introduced by wing sweep. Since leading edge slats have largely been the focus of swept wing aeroacoustics research, few works have sought to understand the noise produced by the flap region of swept wings. Of these, past studies have typically employed a swept and tapered model with a free end which precludes direct comparison to unswept configurations, or have offered only preliminary investigations of underlying flow-noise interactions. Broadly, my work will seek to understand the influence of wing sweep on the production of aeroacoustic noise from the flap, especially its influence on noisy regions, such as the flap side edge (FSE).

This presentation will cover the results from two experimental campaigns conducted in the hybrid anechoic wind tunnel at UTIAS which explore the behaviour of the flap region of two-element swept 30P30N airfoil. Various angles of attack were tested with the flap fully deployed and the flap partially stowed. In the partially stowed configuration, two FSE rake angles were tested, one aligned in a hingewise manner and the other in a streamwise manner. Collected measurements included mean surface pressures, far field acoustic pressures using a phase microphone array, and velocity fields using particle image velocimetry.

The flap behaviour was found to be insensitive to the wing's angle of attack, a beneficial outcome as the swept wing also exhibits substantial flow separation over the outboard region at moderate angles of attack. Acoustic results indicate that, apart from spurious outboard separation noise, the FSE region is a dominant contributor to far field noise and is of interest for future noise treatment tests. Qualitative review of the FSE vortex system found it to behave similarly to the unswept configuration. However, beamforming maps indicate that some alternative source mechanisms (in addition to the FSE vortex system interaction noise) may be significant in the acoustic signature. This behaviour is further quantified through investigations of the FSE vortex system using PIV. Early synthesis of the acoustic and flow field data indicates that the FSE rake angle may be a parameter of interest for further experimental investigations.