Aeroacoustics of flap side edges with adjacent gaps

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Airframe noise is a significant source of noise pollution radiated from aircraft during their approach and landing phases. Within this category, flap side edge noise is a dominant contributor, particularly in high frequencies [1].

We investigated the noise produced by the flap side edge when a gap is introduced between the flap tip and the adjacent wing element. Analytical studies have predicted that increasing the gap produces a flow field that amplifies noise generated by unsteady surface pressure fluctuations [2]. More recent experiments have found that the far-field noise indeed increases with gap size [3]. What remains unclear is whether this increase in noise is caused by the change in unsteady surface pressures or by the change in the acoustic radiation efficiency of the flow field.

In this study, experimental measurements using synchronized particle image velocimetry (PIV) and unsteady surface pressures were performed in the Hybrid Anechoic Wind Tunnel at the University of Toronto. A multi-element 30P30N model was used for the study. The model was modified to remove the slat element to reduce extraneous noise. Three configurations will be presented: a baseline case with no gap, a 2.5%c gap, and a 5%c gap. The model and PIV setup are shown in Figure 1. The presentation will include the flow field and acoustic measurements, as well as a discussion on the noise generation mechanisms.



Figure 1: PIV experiment setup.

References

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