Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Acoustic mode coupling of two facing, shallow cylindrical cavities[1]

PHILIP MCCARTHY, ALIS EKMEKCI, University of Toronto — Cavity mode excitation by grazing flows is a well-documented source for noise generation. Similarly to their rectangular equivalents, single cylindrical cavities have been shown to exhibit velocity dependent self-sustaining feedback mechanisms that produce significant tonal noise. The present work investigates the effect of cavity mode coupling on the tonal noise generation for two facing, shallow cylindrical cavities. This geometric arrangement may occur for constrained flows, such as those within ducts, silencers or between aircraft landing gear wheels. For the latter configuration, the present study has observed that the tonal frequency dependence upon the freestream Mach number, associated with the single cavity feedback mechanism, no longer holds true. Instead, two simultaneously present and distinct large amplitude tones that are independent (in frequency) of speed, propagate to the far field. These two, fixed frequency tones are attributable to the first order transverse mode, and the first order transverse and azimuthal modes for the two combined cavities and the volume between them. Altering either the cavity aspect ratio or the inter-cavity spacing thus changes the acoustic resonant volume and translates the centre frequencies of the observed tones correspondingly.

[1]The authors would like to thank Bombardier and Messier-Bugatti-Dowty for their continued support.

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Date submitted: 01 Aug 2016 Electronic form version 1.4