Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Noise generation by a vortex ring near porous edges: Experiment[1] ZACHARY YOAS, PAUL TRZCINSKI, MICHAEL KRANE, Penn State University — The quiet flight of large owl species has been attributed to their porous trailing edge (TE) plumage. Theoretical and computational efforts by Jaworski and Peake 2013 and Cavalieri et al. 2016, respectively, predicted how the TE sound power scaling law and acoustic directivity change as a function of edge porosity. These predictions have proved difficult to validate in wind tunnels because of background noise. The current study addresses this issue by performing measurements in the ARL Penn State anechoic chamber, and by abstracting the TE noise problem to the convection of a vortex ring past the edge of a non-compact plate. In this manner, the only sound produced is due to the vortex ring/edge interaction. Experiments were performed for a series of plates, each with a different porosity, the control case being a rigid, impermeable plate. The vortex rings, produced by a shock tube, exited from a 6 mm nozzle. Vortex ring motion and size were estimated from Schleiren imaging of the vortex ring motion, captured at 25.1 kHz. Ring speed ranged from 20 m/s to 70 m/s, while the ring radius was 4.5 mm. Twelve microphones, arranged in a circle centered on the plate edge, were used to measure farfield sound pressure and directivity. These measurements were used to estimate the exponent in the *sound power* $\tilde{U}^{\mathrm{n}}$ scaling law. Observed changes in both n and farfield sound directivity with porosity were compared to theoretical predictions.

[1]Acknowledge support from NSF CBET-1804445

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Date submitted: 09 Aug 2020 Electronic form version 1.4