Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Three-Dimensional Flow Separation Induced by a Model Vocal Fold Polyp[1] KELLEY C. STEWART, BYRON D. ERATH[2], MICHAEL W. PLESNIAK, The George Washington University — The fluid-structure energy exchange process for normal speech has been studied extensively, but it is not well understood for pathological conditions. Polyps and nodules, which are geometric abnormalities that form on the medial surface of the vocal folds, can disrupt vocal fold dynamics and thus can have devastating consequences on a patient's ability to communicate. A recent in-vitro investigation of a model polyp in a driven vocal fold apparatus demonstrated that such a geometric abnormality considerably disrupts the glottal jet behavior and that this flow field adjustment was a likely reason for the severe degradation of the vocal quality in patients. Understanding of the formation and propagation of vortical structures from a geometric protuberance, and their subsequent impact on the aerodynamic loadings that drive vocal fold dynamic, is a critical component in advancing the treatment of this pathological condition. The present investigation concerns the three-dimensional flow separation induced by a wall-mounted prolate hemispheroid with a 2:1 aspect ratio in cross flow, i.e. a model vocal fold polyp. Unsteady three-dimensional flow separation and its impact of the wall pressure loading are examined using skin friction line visualization and wall pressure measurements.

[1]Supported by the National Science Foundation, Grant No. CBET-1236351 and GW Center for Biomimetics and Bioinspired Engineering (COBRE).
[2]currently at Clarkson University

Michael Plesniak
The George Washington University

Date submitted: 12 Aug 2012 Electronic form version 1.4