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The Sudden Onset of Acoustic Effects with Increasing Nozzle-Chevron Length In a Mach 0.9 Jet RYAN A. FONTAINE, Department of Mechanical Science & Engineering, University of Illinois, JOANNA M. AUSTIN, GREGORY S. ELLIOTT, Department of Aerospace Engineering, University of Illinois, JONATHAN B. FREUND, Departments of Mechanical Science & Engineering and Aerospace Engineering, University of Illinois — The addition of chevrons to the exit of a jet has been found to reduce far-field noise, making it an effective passive noise reduction technique. The selection of specific designs, however, is challenging since mechanics models provide insufficient guidance and computations remain far too expensive for trial-and-error parameter exploration. To assess the design optimization problem, we have experimentally evaluated parametric dependence of sound on chevron geometry. Specifically, rapid prototyping is used to change the model geometries and study the relationship between chevron length and the far-field jet noise. We show that the effect of the chevron starts relatively abruptly for lengths less than 4 mm, which is well less than the 16 mm length selected as a starting point from previous studies. Thus a small increase in the chevron length can produce a large change in the far-field sound. However, for longer chevrons the sound is insensitive to the length, which has important implications for design optimization. Additionally, other flow diagnostics are performed to better understand the flow characteristics resulting in the observed changes in jet noise.

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